THE

REPERTORY

OF

PATENT INVENTIONS,

AND OTHER

Discoveries & Improvements

IN

ARTS, MANUFACTURES,

AND

AGRICULTURE;

BEING A CONTINUATION, ON AN ENLARGED PLAN,

OF THE

Repertory of Arts and Manufactures,

A WORK ORIGINALLY UNDERTAKEN IN THE YEAR 1794, AND STILL CARRIED ON,
WITH A VIEW TO COLLECT, RECORD, AND BRING INTO PUBLIC NOTICE,
THE USEFUL INVENTIONS OF ALL NATIONS.

NEW SERIES.—VOL. I.
January—June, 1834.

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1834.

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ADDRESS FROM THE PROPRIETOR.

The completion of the first volume of the New Series of this Work, affords the Proprietor an opportunity of acknowledging the increased support with which his efforts to render the publication more extensively useful have been favoured. Having secured the cooperation, as Editor, of a gentleman who is especially conversant with its most prominent and leading feature, the number of *Specifications* given at large has been greatly augmented, the present volume containing double the average number of those in each of the four volumes published before the work passed into hands of the present Proprietor;—while great care has been exercised, and no expense spared, in procuring the most valuable and interesting. The Proprietor has great pleasure in calling the attention of the public to the extensive and correct reports of Law Cases respecting Patent Rights, also contained in this volume. The publication of these cases must unquestionably tend materially to diffuse a more general and correct knowledge of this important branch of the law, an intimate acquaintance with which would appear to be necessary to every person engaged in manufactures. The section entitled the "*Progress of Science applied to the Arts, &c.*," is generally allowed to be a valuable addition to the work, and is a feature distinguishing the Repertory from every other periodical. It will have been observed that the cost of the Supplementary Number has been dispensed with, which the Proprietor is happy to find has given general satisfaction to the public, the more so that the quantity of matter, by the use of small type and the addition of several extra pages, has been greatly increased. This volume, then, may be taken as a specimen of the plan on which the work will in future be conducted; and it is hoped that it will be found fully adequate to supply the want, which is admitted, by scientific men, to have existed, of a publication of this description.

Thus much for the intention and object of the Proprietor, in which the Editor most cordially unites, and will by his best exertions endeavour to fulfil.

A few words are now requisite on the subject of the legal Proprietorship of the copyright of "THE REPERTORY OF PATENT INVENTIONS, &c. &c." Much falsehood and misrepresentation having been published on this point, it becomes necessary to apprise the subscribers, in order to prevent their being imposed upon, that the copyright is vested, by Deed of Assignment, in the *present Proprietor;* and that the original Assignment is from Mr. Wyatt, the first proprietor and publisher of "The Repertory of Arts,"—who, on commencing a third series, altered the title of the Work to "*The Repertory of Patent Inventions.*" The present Work being the only continuation of "The Repertory of Arts," and having been so assigned to the present Proprietor, any other publication purporting to be a "continuation of the Repertory of Arts," purports to be what it *is not,* and an attempt is thus made by its conductors to foist upon the public a spurious for a genuine work. Neither has "*The Repertory of Patent Inventions*" ever been united with any other work, although a direct offer to that effect was made to the present Proprietor, a few months since, but which was immediately rejected. Any publication, therefore, professing to be "*conjoined*" with this work, professes what is false—and *its* conductors are thus attempting to impose upon the public; and, under the credit of being conjoined with "*The Repertory of Patent Inventions,*" are endeavouring to gain a circulation for that which might otherwise fail to attract the least attention. But enough—the Proprietor of "The Repertory of Patent Inventions" is satisfied that this Work will bear the test of comparison with any other publication having a similar object in view; the Specifications it contains *are true copies from the originals,* and the drawings are given with the minutest care; and its Editor *has never yet found it necessary to fill his pages, month after month, with Specifications and Drawings plundered from a contemporary publication.*

LIST

OF

SPECIFICATIONS OF PATENTS

CONTAINED

IN VOL. I. (NEW SERIES)

OF

"THE REPERTORY OF PATENT INVENTIONS."

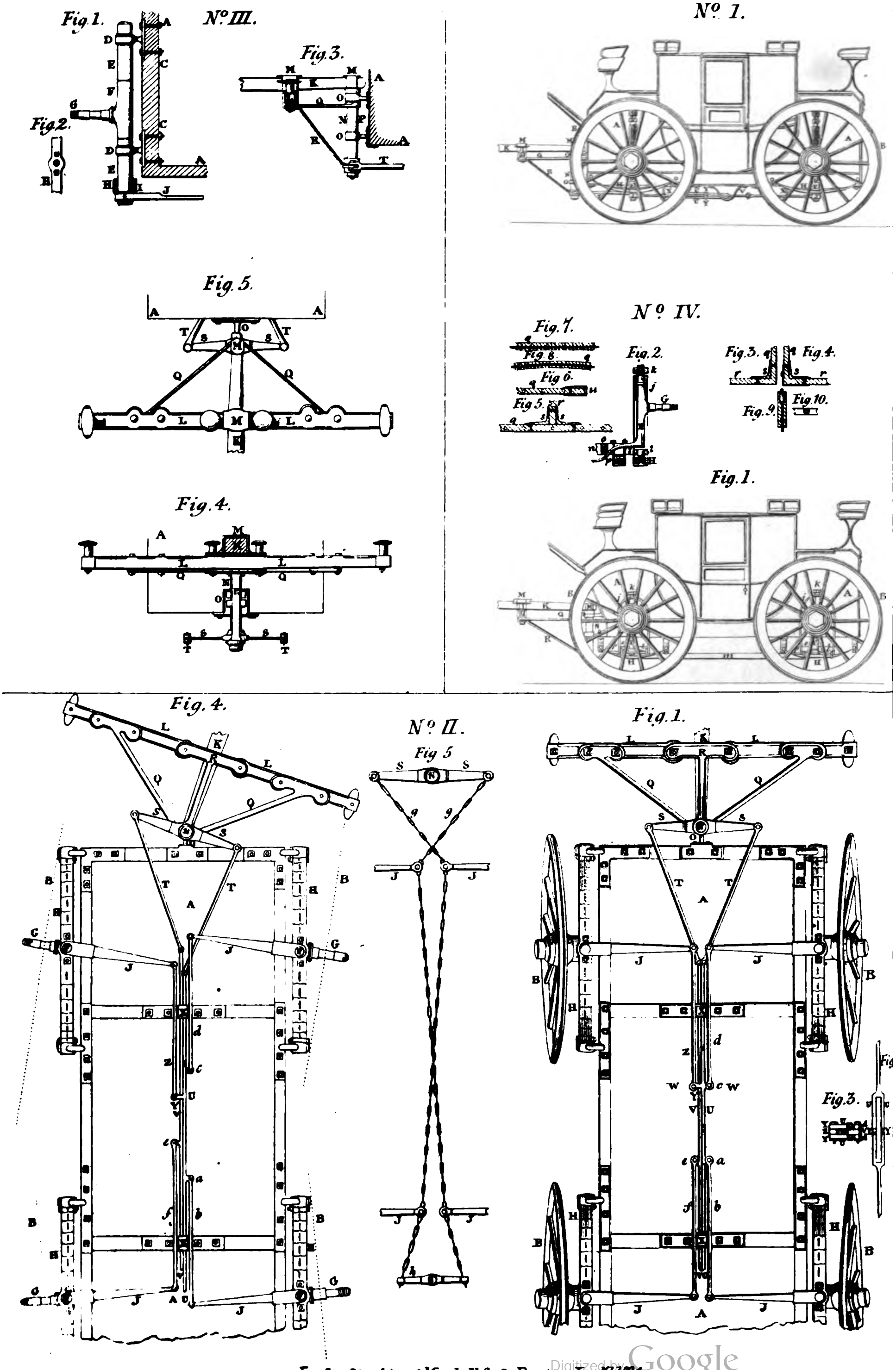
ERRATA.

Page 176, line 7 from bottom, *for* 3200 *read* 32000.

177, — 3, *for* " $\frac{3}{16}$ tin, smelt]" *read* " $\frac{3}{16}$ tin] melts."

178, — 1 to 10, the quotation should extend to the end of the paragraph; thus: "approximative merely."

Gibbs & Chaplins Patent.



London, Simpkin and Marshall, for the Proprietor. Jan.y 1. 1834.

THE

REPERTORY

OF

PATENT INVENTIONS.

No. I. NEW SERIES.—JANUARY, 1834.

Specification of the Patent granted to JOSEPH GIBBS, *of the Kent Road, in the County of Surry, Engineer; and* WILLIAM CHAPLIN, *of the Adelphi, in the County of Middlesex, Coach Master; for certain Improvements in Wheeled Carriages, and in the means of Constructing or Making the same.*—Sealed March 8, 1832.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, we, the said Joseph Gibbs and William Chaplin, do hereby declare that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following description thereof (that is to say):—

Description of the Drawing.

Drawing No. 1, is a side view or elevation of a four-wheeled carriage; and

Fig. 1, of drawing, No. 2, is an under view thereof; in both of which figures, as well as in several others the same letters of reference, indicate the similar parts; A,A, the body of the carriage; B,B, the wheels. These are attached to the body of the carriage in the following manner:

In drawing No. 3, fig. 1, C,C, is an upright standard, or part of the frame-work of the carriage body, to which the sockets or loops, D,D, are affixed by screw-bolts, or other proper means. In these loops, D,D, the cylindrical parts, E,E, made at each end of the upright shaft, F, are received, and are capable of turning and moving upwards and downwards therein. Of course, three other upright standards and shafts similar to these are likewise provided; and to each shaft, F, an arm or axle-tree, G, is affixed at right angles, upon the box in the nave of each wheel is fitted, and secured in any well-known, fit, and proper manner.

The springs, H,H, in drawings 1, 2, and 3, which are affixed to the under part of the body of the carriage, A,A, by screw-bolts and shackles, have circular holes made through them, as shewn in part of one of them at fig. 2, of drawing, No. 3; and through which holes the lower cylindrical parts, E, formed upon the upright shafts, F, F, pass; a collet, or washer, I, is then placed upon the cylindrical part, E, under the springs, and below that collet an arm, or guiding lever, J, is affixed upon the shaft, F, and secured by a screwed bolt and nut, as shewn at J, J, in drawing, No. 1. The four guiding levers, J, J, J, J, are all shewn in the under view of the splinter-bar; the pole is lodged between the two square sockets, M, M, one of which is affixed upon the splinter-bar, L, as shewn in drawing, No. 1; and the other upon the upper end of a cylindrical shaft or axis, N, shewn separately in figs. 3 and 4 of drawing, No. 3; and which said shaft, N, passes through, and turns in, two sockets or loops, O, O, which are affixed to the front of the body of the car-

riage at P, and, as shewn separately in fig. 3, of that drawing.

Q, Q, are horizontal diagonal rods, or braces, shewn in drawing, No. 1; and in drawing, No. 2, fig. 1; and also separately, in drawing, No. 3, figs. 3, 4, and 5.

R, is a central diagonal brace, affixed underneath the splinter-bar, L, and descending to the lower end of the upright axis, N, where it spreads out on each side, forming the double armed lever, S, S; and which is thus immovably united with, and retained parallel to, the splinter-bar, L. To each end of the lever, S, S, is jointed a connecting-rod, T, T, the other ends of which connecting-rods are also jointed to the sliding-rods, U, V, as shewn in drawing, No. 1; and in drawing, No. 2, at fig. 1. The sliding-rods pass through two staples, X, X, which have stems to them, whereby they are securely affixed to the under part of the carriage body, A, A, as shewn in drawing, No. 1, and in fig. 1, of drawing, No. 2.

The sliding-rod, U, U, has a groove or slit formed in it, as shewn in the separate edge or side view of it, fig. 2; it has also two ears, Y, Y, shewn in the end view and section, fig. 3, which is taken at the dotted line, W, W, of fig. 1, drawing, No. 2, affixed upon it at the central part of the slit, which receive between them an eye or loop, formed at one end of a connecting rod, Z, the other end of which has also a double eye or loop formed upon it, into which another loop, made at the inner end of one of the guiding arms, J, is received, and connected therewith by a pin passed through the eyes or loops, and secured by a key.

The sliding-rod, U, U, has also a single ear, eye, or loop, formed upon it, at the opposite side of it, as shewn at *a*, which is received between a double eye or loop, formed upon one end of another connecting-rod, *b*, and which has, at its other end, another double eye or loop, which receives within it an eye or loop, formed at the inner end of another guiding arm, J.

The sliding-bar, V, besides passing through the guiding-staples, X, X, also passes between the two ears, Y, Y, of the sliding-rod, U, U, and has affixed upon one of its sides or edges, a single ear, *c*, which passes through the slit or groove in the sliding-bar, U, U, and receives upon it a double eye or loop, formed on one end of a connecting-rod, *d*, at the other end of which another double eye, or loop, is made, which receives within it a single eye, or loop, made at the inner end of a third guiding-arm, J.

Upon the opposite side or edge of the sliding-bar, V, another ear, *e*, is affixed, which is received between two eyes, or loops, made at one end of a connecting-rod, *f*, and the other end of which rod has also two eyes, or loops, formed upon it, into or between which, a single eye or loop, made at the inner end of a fourth guiding-arm, J, is received; all these joints being connected by pins passed through the holes, eyes, or loops; and the pins secured in their places by keys, as above-mentioned.

The altered positions of these several parts, when the four wheels are caused to lock, in turning the carriage one way, are shewn in fig. 4, of drawing, No. 2; and whereby their action is rendered more evident; the wheels, B, B, B, B, being indicated by dotted lines.

Fig. 5, of drawing, No. 2, represents another method of locking the four wheels of a carriage, mounted as herein-before described; by communicating motion to the four guiding-arms, or levers, parts of which are shewn at J, J, J, J, from the double-armed lever, S, S, by means of the two doubly-crossed chains, *g*, *g*; and the other ends of which said chains are affixed, by screwed loops, with binding nuts, passing through holes, to the outer end of another double-armed lever, *h*, which turns upon an upright axis, *i*, with necks, or pivots, at its ends, mounted in proper supports affixed to the body of the carriage.

In drawing, No. 4, fig. 1, is a side view or elevation of a method of applying our improved system of locking to the four wheels of a carriage of another construction, it hav-

ing telegraph springs to it, and which, in consequence, require certain modifications to be made; for instance, the upright shafts, F, F, instead of having cylindrical parts formed at their upper and lower ends, to allow of an upward and downward movement in the sockets, or loops, D, D, of the carriage before described, have necks, or pivots, and shoulders, at each end, the uppermost necks being passed through cylindrical holes, made in the stirrup-shaped parts, *j*, *j*, and secured by binding-nuts and screws, *k*, *k*. These stirrup-shaped parts, *j*, *j*, are affixed to the side-springs, by staples, with screws and nuts, *l*, *l*.

Fig. 2, is a cross view and section of the several parts; G, being one of the axletrees; and J, one of the guiding-arms, or levers, formed of one piece with the shaft, F, and bent so as to adapt it to be jointed to the sliding-rods, or chains, in either of the modes herein-before described: *m*, in figs. 1 and 2, is one of two wooden perches, underneath the body of the carriage; *n*, fig. 2, is one of two iron plates; or an extension of the inner edges of the stirrups, *j*, *j*, reaching across from one of the stirrups to the opposite one, and connecting them together both in the front of the carriage and behind; and *o*, figs. 1 and 2, are wooden blocks, or stays, several of which are introduced between the two iron plates, and secured by bolts; thus forming the two beds, at the ends of which the axletrees of the fore and hind wheels are affixed by means of the stirrup-shaped pieces, as before-mentioned. The perches, *m*, *m*, are secured to these beds, *n*, *n*, by staples, *p*, *p*, with screws and nuts to them.

In framing the bodies of wheeled carriages, and in order to obtain strength and lightness, we introduced iron, or other metal, rods, into the substances of the wooden pannels, employed in place of the ordinary standards and ribs; having previously bored holes in the said pannels, to receive the metal rods, in any of the usual and well-known methods; these pannels we combine or unite

together in various modes, according to the different purposes they are to be applied to; for instance, we strengthen the joint or angular union of the two pannels, *q*, and *r*, fig. 3, by means of the angular piece of metal, *s*, which extends along the joint, and is secured to the pannels by means of rivets. We can also further strengthen the joint, by adding a bent metal plate clip thereto, as shewn at *t*, in fig. 4. In case of combining two pannels, *q*, and *r*, so as to form partitions, &c., as shewn in fig. 5. We employ two angular metal pieces, *s*, *s*, secured thereto by rivets; and in order to strengthen the outside edges of the pannels, we surround them with bent metal plates, secured by rivets, as shewn at *u*, in fig. 6. When it is required to bend the pannels, as in the case of the roofs or other parts of the bodies of wheeled carriages; previously to boring the holes to receive the metal rods, we cut a number of angular or tapering gaps, or notches, across, and partly through, the substance of the pannels, sufficiently tapering to allow the curvature to take place before the inner sides of the gaps or notches come into contact.

Fig. 7, shews the pannel, and a metal rod inserted in its place ready for bending; and fig. 8, represents it in the bent state. When the pannel is formed of several pieces in length or breadth, and it is necessary to keep them in contact, we either make a head at one end of the metal rod, and a screw at the other end of it, or from a screw at both ends of it; and upon the said screw or screws we bind a female screw or screws, with a broad head or heads to them, and as shewn in section, at fig. 9, and in plan, at fig. 10. And in the cases where we have mentioned rivets to be used, we can occasionally substitute screws and nuts in place thereof.

In witness whereof, &c.

—*Enrolled September* 8, 1832.

Jacquessons Patent.

Fig. 1.

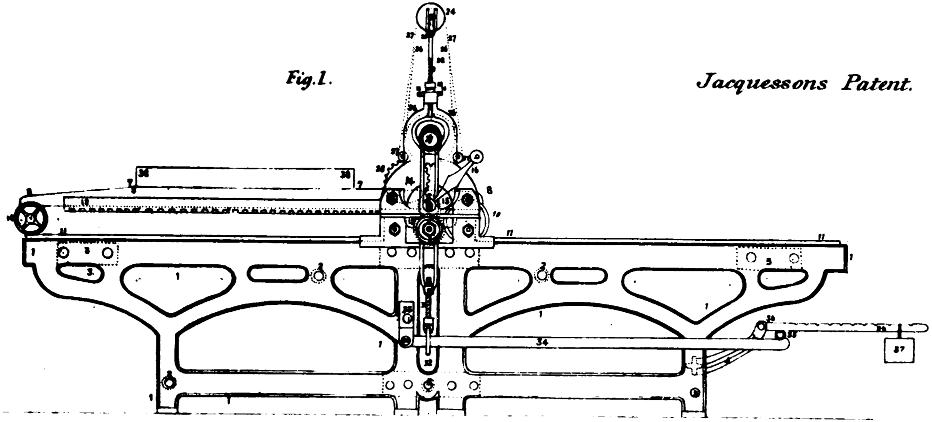


Fig. 2.

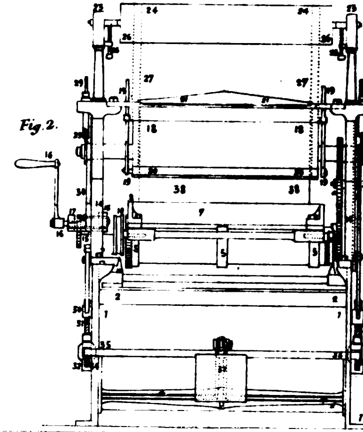
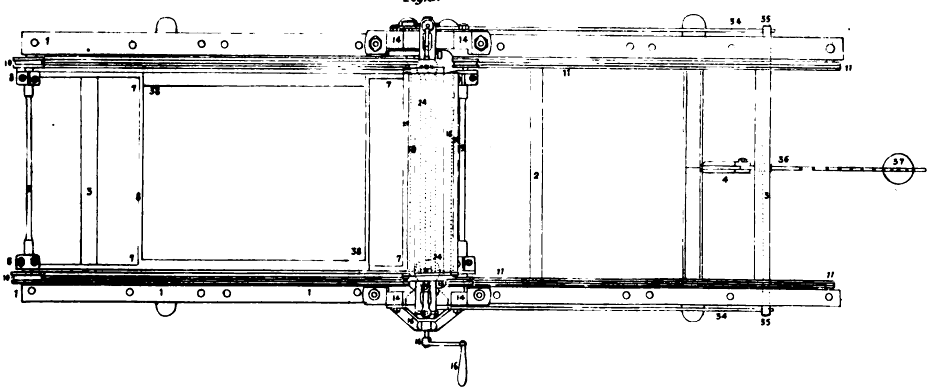


Fig. 3.



Beart's Patent.

Fig. 2.

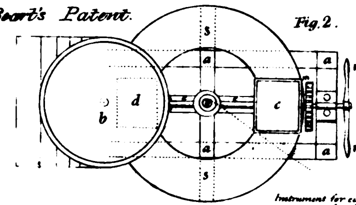


Fig. 1.

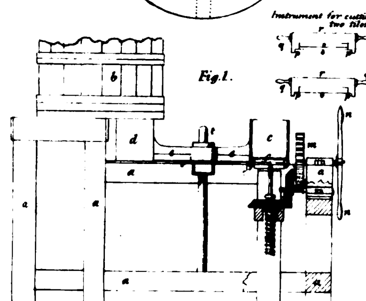


Fig. 3.

London Simpkin and Marshall, for the Proprietor. Jan.^y 1. 1834.

Specification of the Patent granted to Adolphe Jacquesson, *of Leicester Square, in the County of Middlesex, Esquire, for certain Improvements in Machinery or Apparatus applicable to Lithographic and other Printing. Communicated by a Foreigner residing Abroad.*—Sealed July 6, 1831.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Adolphe Jacquesson, do hereby declare the nature of the said invention, as communicated to me from abroad, and the manner in which the same is to be performed and carried into effect, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):—

The invention consists in combining several well-known parts in such manner as to produce an arrangement of machinery or apparatus applicable to lithographic printing, as well also for typographic and copper and other plate printing.

Description of the Drawing.

Fig. 1, is a side view of a lithographic and other printing-press, constructed according to the invention.

Fig. 2, is an end view thereof; and

Fig. 3, is a plan: in each of these figures the same figures and letters of reference indicate similar parts. 1, 1, &c. being the side framing of the machine, the two sides being strongly bolted together by means of the cross-framings, and screws and nuts 2 and 3; the cross-framings 3, 3, being of angle iron to obtain strength with lightness. 4, is another cross-framing at one end of the machine, and has a projection 4, which carries the ful-

crum 36, hereafter described. 5, 5, is a roller or cylinder having three projections formed thereon 5, 5, 5; this roller runs from side to side of the machine, and its axes turn in bearings in the framing 1, 1. On the axis at one end of the roller 5, there is a toothed-wheel 6, affixed, which is driven by the toothed pinion 17, affixed on the axis of the crank-handle 16. This axis 16, has its bearings on one side of the machine. 7, is the table on which the stone is placed when the machine is used for lithographic printing, or the form of type, or the copper or other plate, when those descriptions of printing are to be performed. The table 7, consists of three longitudinal framings of iron, strongly framed together by cross-framings, having a flat plate of iron which forms the surface of the table: the longitudinal framings are supported by the three projecting parts 5, 5, 5, formed on the roller or cylinder 5. The surface of the table is indicated by the fig. 8. The table 7, 8, is carried by four grooved wheels 10, 10, &c. which turn on axes 9, 9. These wheels run on straight edges or rails 11, 11, &c. fixed on each side of the machine. These rails 11, 11, &c. act as guides for the wheels 10, 10, &c. and consequently the table which carries the stone or other surface to be printed from. The table 7, 8, may either be formed of separate parts, or in one casting. 12, 12, is a rack affixed on one side of the table 7, 8; and by means of the toothed wheel 13, affixed on the same axes as the toothed wheel 6, the table is moved backwards and forwards under the printing-cylinder. 14, 14, are framings affixed on the framings 1, 1, &c. on each side of the machine, by means of screw-bolts and nuts, as represented in the drawing. 15, 15, are the bearings of the axis of the crank-handle 16: on the axis 16, there is a pinion 17, affixed, which drives the toothed wheel 6. The impression in this machine is given by means of a cylinder which I prefer to be cast of cast-iron, accurately turned on its surface; yet the same may be made of any other suitable material. The axes of the

printing-cylinder 18, turn in bearings or brasses on each side of the machine, such brasses or bearings being carried by the iron straps or loops 29, similarly formed to a stirrup. These straps 29, are raised or lowered by means of the screws 29, acted on by their respective nuts 29; and thus the space between the cylinder 18, and the table 7, 8, is regulated to accommodate the same to the thickness of the stone or other surface fixed on the table 7, 8. When the machine is to be used for printing from a stone having only writing thereon, or when printing from a form of type, in which so much care is not requisite, and where quick printing is required, an endless printing blanket or felting 27, 27, is used: this endless blanket or felting passes under the printing cylinder 18, and over the roller 24; the axes of which roller 24, turn in slits or gaps 23, on each side of the machine, as shewn in the drawing; and the roller 24, is adjusted by means of the adjusting screws 25, 25, which support the axes of that roller 24. The roller 24, is caused to turn by means of the straps 26, 26, which are actuated by means of the printing cylinder 18; and the printing blanket or felting is kept distended by means of the two rollers 20, 20, which are carried in the forked frame 19, 19. The upper parts of the frames 19, pass through the cross-bracing or framing 21, 21, and are permitted to slide up and down, and they are retained in any position by the adjusting screws *n*, *n*. It will be seen that the small rollers 20, 20, turn on axes in holes drilled in the lower ends of the forked framings 19, 19.

On one of the axes of the roller 5, there is a toothed wheel 28, affixed, which takes into and drives an intermediate toothed wheel *a*, the axis of which intermediate toothed wheel is affixed in a curved slot formed in the side framing, by which means this intermediate wheel may be made to accommodate the variation of distances between the toothed wheel 28, and the toothed wheel *b*, which latter is affixed on one of the axes of the printing cylin-

der 18, and that cylinder is driven by the motion given to the roller 5, such motion being communicated from the toothed wheel 28, to the intermediate toothed wheel *a*, and thence to the wheel *b*.

Pressure is communicated to the printing cylinder 18, by means of levers and weights, in the following manner: 30, 30, are two iron loops which act on the upper brasses on the axes of the printing cylinder 18: these loops 30, 30, are pressed downwards by means of the levers 34, which pass through the slits or holes 32, formed in the lower parts of adjusting screws 31, 31. Each of the levers 34, has a fulcrum 33, affixed on each side of the machine; and they are further supported by means of the plates 33, fixed on the side-framings 1, 1, of the machine. 36, 36, is another lever, having its fulcrum at 36, carried by the projecting part of the framing 4. This lever 36, is brought to act on the ends of the levers 34, 34, by means of the cross-rod or bar 35, which rests on the ends of the levers 34, 34, as is clearly shewn in the drawing. 37, is a weight; and according to the pressure required, the weight 37, may be moved near to, or farther from the fulcrum 36, for the purpose of decreasing or increasing the pressure to the printing cylinder 18. I would observe, that when quick printing is required, a smaller toothed wheel *b*, may be placed on the axis of the roller 5; but where large and fine prints are to be taken, then a larger wheel 6, is to be used.

The object of thus changing the wheel 6, is, that when quick printing is intended, it is desirable to make as many revolutions of the printing cylinder, with as few revolutions of the crank handle; but, on the contrary, when large and fine prints are to be taken, then slow motion is desirable, with considerable pressure. And I would further observe, that when fine prints are being taken from off lithographic stones, or from copper or other plates, then, in place of using the endless blanket or felting, or other printing fabric, I make use of one or

more sheets of smoothly pressed pasteboard laid on the top of the paper which is to receive the impression. In using the machine, I carefully fix the stone, or surface to be printed from, on the table 7, 8, taking care that the printing surface is truly parallel with the printing cylinder; I then, by hand, place a sheet of paper on the printing surface: and when the endless printing blanket is used, no sheet of pasteboard is required. The table is then run under the printing cylinder, and the impression given, which is to be removed, and another sheet of paper placed on the printing surface, and the table is to be run back under the printing cylinder.

Having now described the nature of the invention, and the manner in which the same is to be performed and carried into effect, I would have it understood, that I lay no claim to any of the various parts separately. But I do claim as the invention, the combining of the various parts in the manner above described.

In witness whereof, &c.

—*Enrolled January* 6, 1832.

Specification of the Patent granted to Robert Beart, *of Godmanchester, in the County of Huntingdon, Miller, for certain Improvements in making or producing Tiles, for Draining Lands, Buildings, and other Purposes.*—Sealed May 25, 1833.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Robert Beart, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon; (that is to say):—

My invention relates to a peculiar arrangement of moulds and manner of working tiles therefrom, as will be fully described hereafter, whereby tiles may be produced with greater facility than by the ordinary means of making them. But in order that my invention may be fully described and ascertained, I will now describe the drawing hereunto annexed, and the figures and letters marked thereon; (that is to say:)—

Description of the Drawing.

Fig. 1, is an elevation of a machine, having two moulds constructed according to my invention, some of the parts being in section, the more clearly to shew their construction.

Fig. 2, is a plan of fig. 1; in each of the figures the same letters refer to similar parts: *a, a*, is a strong frame of wood, or other material, which supports the machinery; *b*, is an ordinary pug mill for grinding and preparing the clay. At the bottom of the pug mill, *b*, is an opening, by which the moulds, *c, d*, are alternately filled, as will be fully described hereafter. The two moulds, *c, d*, are two quadrangular boxes affixed on the cross-frame, *e*, which turns on a spindle, *t*, midway between the two moulds, *c* and *d;* by this means the moulds may be successively brought under the opening at the bottom of the pug mill, and by the working of the mill, will become filled whilst the clay contained in the other mould is being worked off into tiles. *f*, is a false bottom, (one in each of the two moulds, *c, d*,) resting on ledges, or projecting edges, *g*, at the bottom of the moulds. *h*, is a piston, which being raised by means of a screw, *j*, causes the bottom, *f*, to press up the clay, which is in the moulds; *i*, is a bevelled toothed wheel, its axle turning on proper bearings affixed to the framing of the machine. Through the centre of this wheel is formed a female screw to fit the screw, *j*, which works the piston; *k*, is another bevelled toothed

wheel, which takes into and drives the wheel, *i*, the axes of the wheel, *k*, turning in proper bearings affixed to the framing. On the axis of the wheel, *k*, is affixed a pinion, *l*, and *m*, is a toothed wheel, which takes into, and drives the pinion, *l*. On to the axle of the wheel, *m*, is placed handles, *n*, *n*, for giving motion to this part of the machinery.

Having described the various parts of the machine, I will proceed to describe the manner of its action. In doing so, I will suppose that the mould, *c*, is full of clay, and the mould, *d*, will consequently be under the pug mill, and will be receiving clay therefrom, meanwhile that the clay contained in the mould, *c*, is being worked into tiles. By turning the handle, *n*, the wheel, *m*, will drive the pinion, *l*, and with it the wheel, *k*, and this wheel, *k*, will turn the wheel, *i*, and by means of the screw, *j*, the piston, *h*, will force up the required thickness of clay for making a tile, which is to be removed in the following manner.

Fig. 3, represents the instrument for cutting the thickness of clay from the mould. *o*, is a stretched wire or wires from the points, *p*. In cutting off a tile, the workman will place the parts, *p*, on the mould, the two sides thereof acting as guides, and pressing on the handles, *q*, will draw the wire through the clay, and when cut from end to end, the tile may be readily removed by hand, the upper part, *r*, of the instrument, fig. 3, acts as a strike or level, and is to be passed backwards and forwards over the surface of the clay in the mould to smooth the upper surface. The handles, *n*, are again to be turned, and a second quantity of clay brought above the mould, *c*, which is to be removed in like manner; and so on till this mould is empty. The pug mill is then to be stopped, the piston run down, and the position of the moulds reversed; that is, the empty mould, *c*, under the pug mill, and the full mould, *d*, above the piston, and the manner in which I effect this turning, is by means of a

straight lever, which I place against the corner of the mould, and against the spindle, *t*, in the manner shewn by dotted lines in fig. 2, and thus force the two moulds to revolve on the spindle. *s*, is a circular table, on which the moulds *c*, *d*, travel. The clay in the mould *d*, is to be worked off in like manner to that described of the mould *c*.

It will be evident from the above description, that other figures than square tiles may be produced by forming the moulds to the shape required. The tiles produced as above described, when they are intended for draining tiles, will only require to be bent over a proper shape or mould whilst moist; they are then to be dried, and afterwards finished in the kiln as usual. My invention only relating to the moulds, and manner of working the clay therefrom into tiles, and system of removing the same, and not to any of the other processes, it will not be necessary to go into any further description thereof.

Having now described the nature of my invention, and the manner of constructing and using the same, I would observe, that in place of the moulds remaining stationary whilst the clay is forced up by the piston, it will be evident that the piston may remain stationary, and the moulds descend by means of toothed wheels and racks, or otherwise; and I would have it understood, that although I have described the moulds as combined with and supplied by, a pug mill, I do not confine myself to that manner of using them, as they may be filled by hand or otherwise, but in such case it will be desirable to beat the clay in order to press the same more intimately together, and make it more close grained than it would be by merely putting a quantity into the moulds.

And I would have it understood, that I lay no claim to the various parts separately, of which the machinery is composed, they being separately well known and in use. But what I claim is, the construction of moulds, *c*, *d*, as above described, from which a succession of tiles may

be cut as the clay is caused to project therefrom, as above described.

In witness whereof, &c.

—*Enrolled November* 24, 1833.

Specification of the Patent granted to FRANCOIS CONSTANT JACQUEMART, *of Leicester Square, in the County of Middlesex, Esquire, for Improvements in Tanning certain Descriptions of Skins. Communicated by a certain Foreigner residing abroad.*— Sealed October 20, 1830.

To all to whom these presents shall come, &c. &c.— *Now know ye*, that in compliance with the said proviso, I, the said Francois Constant Jacquemart, do hereby describe the manner in which my said invention is to be performed by the following description thereof, (that is to say) :—

The invention relates to the manner of tanning, preparing, and dressing hares, cats, rabbits, and sea rats' skins, and rendering them fit, through the medium of various preparations mentioned hereafter, to make boots, shoes, gloves, and any other leather goods, little if any advantage having hitherto been obtained from hares, cats, rabbits', and other small skins. All those skins were nearly or entirely lost for the leather trade, since, having cut the hair off, they were only used to make glue or other similar purposes. Having examined the nature of such skins, and submitted them to certain preparations, the inventor has succeeded, after many attempts, to give them the necessary strength and consistency, in such a way as to employ them with advantage in making boots, shoes, gloves, and other leather goods.

First, I proceed as follows: Take the skins; lay them open; pull off the long hair; rub them with mercurial aquafortis, and put them into a heat of about forty-

five or fifty degrees by Reaumur's thermometer. I then cut the hair off, and then take these skins stript of their hair; lay them in the tan preparations. When they have been dried so high as forty-five or fifty degrees, in order to bring them again in their natural state, I put them into a salt water mixed with blood for about six or seven days. Afterwards take them out of it, to put them into a water mixed with blood in the proportion of about one tenth part of blood to nine tenth parts of water, to get the salt out, and deaden or render them supple. Remove them from that lye, and put them into a dead lime water, to cause them to swell or thicken, and put them again for three days into a lime water stronger than the former, to obtain a greater swelling or thickening. To succeed in it, I take one pound of salt pot-ash and eight ounces of orpiment, that I melt together for one hundred skins. Then I throw them into a lime bath about one-fifth stronger than the former ones, and leave the whole for twenty-four hours; after which the hair will drop off perfectly.

Manner of tanning the same skins.—I take away the hair from them, and remove the loose flesh. I have a set of tubs placed upon each other; I fill them with tan; wash them in lye, in order to get the clear liquid out springing from the tan. I then lay upon each tub about one pound of sulphuric acid. When this liquid has reached four degrees in strength, I take out the skins every other day, change them, and replace them in the same liquid till they are nearly tanned. Then I lay the skins in the pit for about one month, after which the skins become much stronger. The currying of them is done like that of other skins, and those reserved for glove making are dressed in the same manner as the white skins for that use.

Second process.—I take the skins, lay them open, pull off the long hair, steep them in a bucket of clear water, and give them the first dressing. I put them

again in the same water during twenty-four hours, take some lime, infuse it, and add to it, for one hundred skins, four ounces of orpiment, which I mix with the lime. I then lay some lime upon each, on the side of the flesh, to make the hair drop off, and pick or remove the loose flesh off; on the fleshy side, in a contrary way to the grain of the hair, to get off the inner skin. I put them then into a new lime water; add to this lime water, for one hundred skins, two pounds of alum and one pound of salt pot-ash, the whole dissolved together. I let the skins remain in the lime-water for the space of eight days; take them out of the lime-water, and dress them every day; wash them thoroughly, put them into a vessel with the tan, and stir or agitate them four or five hours every day; let them remain therein about five or six days. Afterwards, I put them into a vessel with new tan, and add to it, for one hundred skins, eight ounces of sulphuric acid. I let them remain in this fresh vessel a necessary time to get the strength and thickness which are wanted, which is obtained in about twenty-four or thirty hours. I take them out of it, put them into a tan-pit or vessel, and lay some tan between the skins in order to soak them. I take the liquid out of the tan, and mix with it, for one hundred skins, one pound of alum. I let them remain thus for eight days; take them out of it, and lay them in the pit, and let them remain there about a month. I again take them out of it, and curry them like the other skins. The skins for glove-making are dressed in the same manner as the white skins for that use.

My manner of tanning, preparing, and dressing these skins as fur-skins, so that the hair may not fall off, or the moth or mite get into them (these leather furs being thick, strong, and supple, may be employed in making boots, shoes, gloves, and other articles), and have not besides the inconvenience of the furs called untanned furs. I take the skins, lay them open, pull off the long hair, steep them afterwards in clean water; at

the end of twenty-four hours give them the first dressing; put them again into the same clean water for twenty-four hours; take one pound of alum for twenty-five skins; melt it in lukewarm water, and pour that water into a bucket. Then I take the skins, one by one, and dip them in the same water of alum. Let them remain in it for two days afterwards; melt some quick lime in water, and let it get cool. I then take the skins out of the water of alum, and put them into this quick-lime-water. Five or six days afterwards I take them out of the lime-water, put them into clean water, and immediately wash them thoroughly. I then tan, curry, or chamois them in the way before described.

In witness whereof, &c.

—*Enrolled April* 20, 1830.

Specification of the Patent granted to JOSEPH JONES, *of Amlwch, in the County of Anglesea, in North Wales, Gentleman, for an Improvement in certain Parts of the Process of Smelting or obtaining Metallic Copper from Copper Ore.*—Sealed July 17, 1828.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Joseph Jones, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is particularly described and ascertained in the following explanation. The process of smelting or obtaining metallic copper from copper ore, when my improvement is adopted, is as follows:—

The copper ore is to be melted in a melting furnace, and brought, in the usual way, into the state of what is called regule or regulus, or coarse metal, which substance I believe to contain sulphuret of copper with sulphuret of iron, but without asserting positively what its chemical composition may be: the terms regule or regulus, com-

monly used in Anglesea, and the term coarse metal, commonly used in South Wales, are well known to persons conversant with the art of copper smelting. Then the regule or regulus, or coarse metal, is mixed and melted with a portion of copper ore which has not been previously melted; but the copper contained in that ore, must not be in a state of sulphuret; consequently, if the ore mixed with the regule or regulus, or coarse metal, be in its native state, of a sulphureous kind, it must be deprived of its sulphur by strong calcination, previously to so mixing and melting it along with the regule or regulus, or coarse metal. Such previous calcination of the sulphureous ore being effected by the combustion of its own sulphur, in the manner commonly practised in Anglesea, in what are called kilns. By thus melting the regule or regulus, or coarse metal, along with a suitable mixture of copper ore, by way of flux, regulated in manner hereinafter mentioned, there will be no necessity for a long calcination or roasting of the mixture in a furnace, previously to melting the same; and by such mixing and melting the regule or regulus, or coarse metal, as aforesaid, a great part of the iron and other impurities contained in the reg ule orregulus, or coarse metal (as well as in the copper ore mixed therewith by way of flux), will separate from the melted mixture in the form of a slag, which is sufficiently fluid, when in a melted state, to flow out through the furnace tap-hole (or it may be skimmed off from the melted mixture), leaving the product of the fusion more rich in copper than the same regule or regulus, or coarse metal, would have become by undergoing the usual calcination or roasting in a furnace, previous to fusion, without mixing and melting copper ore with the regule or regulus, or coarse metal, as before declared, by way of a flux.

The quantities of regule or regulus, or coarse metal and copper ore used as flux, to be mixed and melted together as aforesaid, should be regnlated in manner here-

inafter mentioned, so as to be apportioned to each other according to their respective qualities, in such manner, as will cause as much as possible of their impurities to flow or be skimmed off in the slag, and leave the product of their fusion in the state of what is called rich grey regule in Anglesea, and in South Wales fine metal or blue metal, or an intermediate stage between that state and the state that is called coarse copper.

The state to which the regule or regulus, or coarse metal, should be converted by *melting* it along with the due admixture of copper ore by way of flux, is that state in which it approaches, as near as possible, to pure sulphuret of copper, which is a compound of about 78 or 80 per cent. by weight, of copper, with 22 or 20 per cent. by weight, of sulphur. If, for want of suitable ore for flux, or if for want of a proper adjustment of the doses of ore and regule or regulus, or coarse metal, to suit their respective qualities, the product of the first fusion should not approach sufficiently near to the state of sulphuret of copper; then that product must be melted again in mixture with more copper ore, until the state of sulphuret of copper is attained as near as can be done; when the product of the admixture above described, is brought, by the means aforesaid, to a state of sulphuret of copper, or to a state approaching to sulphuret of copper, as near as can be done.

The metallic copper is obtained by calcining or roasting in the usual way, when a portion of copper ore (which, either from its own nature, or from previous calcination, is not in a state of sulphuret) is melted along with the regule or regulus, or coarse metal (which I suppose to consist of sulphuret of copper and sulphuret of iron), the copper contained in such ore, as soon as it comes to a state of fusion, begins to combine with the sulphur that is held by the iron contained in the regule or regulus, or coarse metal; and the iron so liberated from its combination with the sulphur, then enters with the earthy

matters into the slag: also during this separation of the iron, a portion of sulphur, and such other substances as can be driven off at a high temperature, make their escape through the chimney of the furnace. To give time for the separation of the iron, the melted mixture of regule or regulus, or coarse metal, and copper ore, should be well stirred, and then allowed to stand some time in the furnace in a state of fusion, before the fluid slag is drawn or skimmed off from the surface of the melted mixture.

The kinds of copper ore which may be used to mix and melt with the regule or regulus, or coarse metal, by way of flux, are sulphureous copper ore after it has been highly calcined by its own combustion, so as to burn away the sulphur, and bring part of the copper contained in the ore, into a state of oxide; and it commonly happens, that some parts of the sulphureous copper ore which has been calcined by its own combustion in kilns (as is the custom in Anglesea), will be found sufficiently calcined, and deprived of its sulphur for the purpose: or any copper ore which is not in a state of sulphuret, may be used to mix and melt with the regule or regulus, or coarse metal, viz. such as is called red copper ore, or black copper, otherwise called black oxide of copper, or blue copper, or malachite, or any carbonate of copper, or copper green, or di-prismatic olivenite, otherwise called lenticular copper, or arseniate of copper. As to the proportions or quantity of copper ore (not in the state of sulphuret) which should be mixed with any given quantity of regule or regulus, or coarse metal, in order to act as a flux therewith, so as to bring the product to the state of sulphuret of copper, or as near thereto as can be done; the same will depend upon the nature of the ore, and the quality of the regule or regulus, or coarse metal; and so of the number of times that the melting of the regule or regulus, or coarse metal, in mixture with the copper ore, by way of flux, must be repeated, in order to

attain, as near as can be, to the state of sulphuret of copper.

It is well known, that the regule or regulus, or coarse metal, obtained from the first melting of some sorts of copper ore, is richer in copper than the regule or regulus, or coarse metal, obtained from other sorts of ore; that circumstance depending, in a great measure, upon the quantities and varieties of the impurities that the ores contain along with the copper. For instance, the copper ores of Anglesea (which are principally sulphureous) are, by the first melting, brought to a regule or regulus containing 45 or 50, or more, per cent. of copper, whilst the Cornish and other ores smelted in South Wales, are commonly brought to a coarse metal containing about 33 per cent. of copper. The copper ores which must be mixed and melted with the regule or regulus, or coarse metal, by way of a flux, will also vary in richness. The quantities of copper ore not in a state of sulphuret, and of the regule or regulus, or coarse metal, to be mixed and melted together for the purpose aforesaid, must be regulated according to the quantity of iron in a state of sulphuret, that may be contained in the regule or regulus, or coarse metal, and the quantity of copper (not in the state of sulphuret) that may be contained in the ore when they are mixed and melted together: the definite proportions in which sulphur will combine with copper and iron respectively, to form sulphurets, are well known to persons conversant in chemistry.

For performing the above process I employ a reverberatory furnace of the common size and construction that is used for melting copper ore, say eleven or eleven and a half feet in length, by seven and a half or eight feet broad at the broadest part. Into this furnace I put one ton weight in a charge of regule or regulus, or coarse metal, and copper ore, mixed in suitable proportions, regulated in manner above mentioned; but the charge may be varied

in quantity according to the number of charges that are required to be melted in the furnace per day, and according to the quantities of the regule or regulus, or coarse metal and ore to be smelted. The number of charges that may be melted in a furnace per day, will, of course, depend on the state of repair of the furnace; but they ought not to exceed five or six charges in twenty-four hours. After the charge is melted, and has been well stirred, it is proper to leave it in the furnace in a melted state for one quarter of an hour, half an hour, or more (if the furnace bottom will bear it without breaking), for the purpose of expediting the process.

I hereby declare, that I claim as my invention and improvement, those parts only, and no others, of the process above stated, of smelting or obtaining metallic copper from copper ore, which begins at that part of the process of smelting above described, after copper ore has been brought to a state of regule or regulus, or coarse metal, and go on in manner above stated by me, until that regule or regulus, or coarse metal, mixed and melted in manner aforesaid with copper ore not in a state of sulphuret, has been brought to a state of sulphuret of copper, or to a state approaching thereto, as near as can be done, in manner aforesaid. I further declare, that the object of my improvement in those parts of the process of smelting or obtaining metallic copper from copper ore, which I claim as my invention, as aforesaid, is to facilitate the separation of iron, sulphur, and other matters from copper ore, after the same has been brought, by the usual means, to the state of regule or regulus, or coarse metal, as well as of the impurities of the ore not in a state of sulphuret mixed therewith, in performing the process above described: such separation by the process above described, certain parts of which I claim as my improvement, as aforesaid, may be effected in a given number of furnaces, being used in less time, and at a less expense than could

be done by the course usually adopted with the same number of furnaces.

In witness whereof, &c.

—*Enrolled January* 17, 1829.

LAW REPORTS OF PATENT CASES.

Vice Chancellor's Court, November 21, 1833.

LINTON v. BEAUMONT.

The plaintiff in this cause obtained an injunction to restrain the defendant from making and using certain description of steam-boilers for which a patent had been granted to the plaintiff in 1832.

The present application was on the part of the defendant to dissolve the injunction, on the ground that there was no novelty in the boiler; and evidence was produced that such was the case.

The Vice Chancellor, in giving his judgment, observed: It appears to me this injunction ought to be dissolved. As far as I can understand the case, the patent is worth very little, because taking it to be true, as sworn, that *this* (referring to a model) does correctly represent the boiler which was used on board the Leeds in 1826, this represents the flues so constructed as to have an horizontal and a vertical space between them, and by reason of representing two as it does, it represents what may be called a series, for two must be the beginning of a series. The only thing, therefore, that can be considered as having any claim to novelty in the plaintiff's invention is the circumstance that he has substituted what he calls four-sided flues, that is parallelograms, in lieu of cylinders. But if you attend to the way in which he has described his invention, it consists in "placing the four-sided flues" (that may be new) "within the boiler-case in manner hereinafter des-

scribed, so as to form a number" (that is general) "of narrow" (which is indefinite) "and comparatively deep vertical with shallow and comparatively broad horizontal channels or spaces." The words "comparatively vertical with shallow and comparatively broad channels or spaces," I take to be so exceedingly indefinite that no patent could rest which was to be sustained on the foundation of such expressions as descriptive of something that was newly invented. Then he says, "horizontal chambers or spaces" between, above, and below the flues for the water of the boiler to flow into it, whereby I am enabled to expose a greater surface of heated flue to a given quantity of water in a given space than can be done by steam-boilers constructed in the ordinary way. Now one would imagine from reading this patent that the invention of allowing the vertical and horizontal spaces to pass through the flues was not heretofore known. The plaintiff, if he took out any patent at all, ought to have taken out a patent by means of which he would claim, as an invention, the substitution of the parallelograms for the cylinder: and then it becomes a question whether, if he has taken out a patent for what he calls a series of four-sided flues, in the way he has described, he has not so blended (if it may so be called) what is purely new—and, I will admit, for the sake of the argument, purely new—with that which is old, as to make it impossible, in looking at the patent at once to discover what is new and what is old; and I cannot but have a very strong opinion that, when the patent comes before a court of law, which I think it ought, it will not be found to sustain the plaintiff's case. An observation made by Mr. Turner seems to me to be of considerable weight (at any rate it is a new thing) that this court was asked peremptorily to interfere upon a patent so new as this, before long-continued usage in favour of the patentee could be supposed to have given him a right, even though there might be a doubtful description in the patent; and also it was applied for on the ground, which I remember at the time made an impres-

sion on me, that there had been something like a fraudulent dealing on the part of the agent of the defendant. I think therefore that this part of the case is totally disproved, and that the injunction ought to be dissolved; that no account ought to be kept, and that the plaintiff ought to have liberty to bring such action as may be advised within a reasonable time.

Observations as to the Cause of the Spontaneous Combustion of Charcoal, in reference to COLONEL AUBERT'S *and* MR. HADFIELD'S *Experiments.* By Mr. F. COXWORTHY, of the Ordnance Department. Dated London Mechanics' Institution, January, 1832.*

THE spontaneous combustion of carbonaceous substances is a phænomenon which has long been under consideration, not only in respect to charcoal, but also of that body mixed with oil, of flax, hemp, hay, and others; and although numberless experiments have been made, no one, to my knowledge, has ever advanced an opinion as to the cause, which, in respect to charcoal, I consider as being solely attributable to the decomposition of moisture by potassium.

When it is considered that the oxidation of metals is difficult in proportion to their being protected by the earths or other substances, as is shewn by iron, during the process of copper smelting, it will not appear strange that potassium, notwithstanding its great affinity for oxygen, should be preserved in its metallic state in a mass of charcoal; which being admitted, its action on moisture may be explained by the following rationale:

Hydrogen (possibly potassiuretted).

Hygrometric moisture	{ Oxygen Hydrogen	Carbon Potassium }	Charcoal.

Carbon and potash.

The moisture, when admitted to the potassium, becomes

* Communicated by the author. See Repertory for September last.

decomposed, its oxygen combining with that metal, while the hydrogen, being liberated, continues ascending towards the surface until it reaches the influence of atmospheric pressure, where it is stopped so long as its elasticity is insufficient to overcome it, and escaping only, when, by accumulation and increase of temperature by chemical action, it has obtained sufficient force to do so, thus presenting at once a considerable body of gas to the action of the oxygen contained in the atmosphere. In this opinion I cannot but consider myself as being fully borne out by the results of Mr. Hadfield's and Colonel Aubert's experiments.

Mr. Hadfield's two first experiments show, that old charcoal which had been long exposed to the action of a damp atmosphere, did not rise to so high a temperature as new, which, on the above assumption, could not possibly be otherwise, for a portion of the potassium having already become oxidated, the remainder could not be capable of causing so great an action, by the decomposition of water and liberation of its heat, as that which had not undergone a change.

Combustion taking place generally near the surface,— next to the wall when charcoal is placed against one,— and re-ignition twenty-four hours after the fire had been extinguished by water; as well as long jets of fire proceeding from charcoal, on its being tilted from a cask, may all be adduced in support of my views, to which may be added that in Mr. Hadfield's experiments, which he performed with coarse charcoal, combustion generally took place six inches below the surface; whilst Colonel Aubert's charcoal, being considerably finer, took fire short of two inches of the surface.

If the above conclusions are correct, it will be no longer considered a matter of surprise, that a thermometer placed in a bad conductor of heat (lead), and surrounded by one of the very worst (charcoal), should be but slightly affected, while combustion was actually going on within six inches of it.

PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

Resistance of Fluids to Bodies passing through them.—The following notice has recently appeared of a paper entitled "An Account of a Second Series of Experiments on the Resistance of Fluids to Bodies passing through them;" by James Walker, Esq. F.R.S., Civil Engineer; which was read before the Royal Society, on June 6th, 1833.

The author, in a paper read to the Society in the year 1827, and printed in the Philosophical Transactions, gave an account of some experiments shewing that the resistance of fluids increases in a ratio considerably higher than the square of the velocity, and that the absolute resistance is smaller than had been deduced from the experiments of the French Academy. In the present communication he states the results of his further inquiries on this subject. His experiments were made at the East India Docks, on a boat twenty-three feet long and six wide, with the stem and stern nearly vertical; one end being terminated by an angle of forty-two degrees, and the other of seventy-two degrees; and the resistance to the boat's motion being measured by a dynamometer. The results are given in tables; and it appears from them that in light vessels sharpness is more important in the bow than in the stern; but that the reverse is the case in vessels carrying heavy cargoes. From another series of experiments the author infers that the resistance to a flat surface does not exceed 1·25 lb. for each square foot, at a speed of one mile per hour; increasing for greater velocities, in a ratio considerably higher than the square of the velocity. The author concludes with some observations on the results lately obtained in Scotland, where great velocities were given to boats moving on canals,

without a proportional increase of resistance.—*Proceedings of Royal Society.*

INFLUENCE OF COLOUR ON THE ABSORPTION OF HEAT AND OF ODOROUS PRINCIPLES.—On the 20th of June, 1833, a paper was read before the Royal Society, "On the Influence of Colour on Heat and Odours;" by James Stark, M.D., of Edinburgh; of which the following is an abstract:—

The author observes, that the only experiments on record relating to the modifying effect of different colours on the absorption of heat from solar light, are those of Franklin and of Sir H. Davy. In order to investigate this subject, the author employed pieces of wool, silk, and cotton, which were wrapped round the bulb of a thermometer placed in a glass tube; the tube was then plunged into boiling water, and the time which elapsed during the rise of the thermometer from one given point to another was accurately noted. Other experiments were also made with an air-thermometer, of which the bulb was coated with various coloured materials, and heat thrown on the ball by means of polished tin reflectors from an Argand burner. The results accord very nearly with those of Franklin and of Davy; the absorbing power with regard to different colours being nearly uniformly in the order of black, brown, green, red, yellow, and white. The author next investigates the differences which occur in the radiation of heat by differently coloured substances; a subject on which he is not aware that any experiments have ever been made previously to his own. The mode of ascertaining the amount of radiation was generally the converse of that by which the absorption of heat had been determined; namely, by exposing the coloured substances, in contact with a thermometer, to cooling instead of heating processes. The general result of all his experiments was, that the loss of caloric by radiation follows exactly the same order, with regard to the colour of the radiating surface, as its

absorption. In the second part of his paper the author gives an account of a course of experiments which he made with a view to discover the influence of colour on the absorption of odorous effluvia, and more especially in the case of the absorption of the fumes of camphor and assafœtida by woollen cloth of different colours. Black cloth was always found to be possessed of the greatest absorbing powers, and white of the least; red cloth being intermediate between them. Cottons and silks gave, on trial, precisely the same results, which were further confirmed by the different weights acquired by these substances from the deposition of camphor upon them.—*Proceedings of Royal Society.*

Theory of Putrescent Manures.—Sir Humphry Davy was the first who embodied into a system the principles of chemical science as applied to the operations of agriculture, and which system was first promulgated in a course of lectures delivered before the late Board of Agriculture. In that system was detailed all that was at that time known of scientific agriculture. Among the many other statements in that system, occurs the following, in regard to the application of rotten dung. "As soon," says this distinguished chemist, "as dung begins to decompose, it throws off its volatile parts, which are the most valuable and most efficient. Dung which has fermented, so as to become a mere soft cohesive mass, has generally lost from one-third to one-half of its most useful constituent elements, and that it may exert its full action upon the plant, and lose none of its nutritive powers, it should evidently be applied much sooner, and long before decomposition has arrived at its ultimate result." This opinion was promulgated in 1809, and it has till lately received the confidence of most chemists. But experience nevertheless continued to act in direct opposition to this opinion. Manure continued to be applied in "a soft cohesive mass," and it continued to raise large crops; whereas, had it been applied "long before

decomposition had arrived at its ultimate result," the result would inevitably have been a loss of crop, manure, and labour.

It is certainly an erroneous assumption to say, the first stage of fermentation in dung must necessarily throw off its most valuable parts. Every dunghill of fresh dung throws off a gaseous exhalation a very short time after it is put together, and the quantity thus thrown off is regulated by the state of the atmosphere. But this exhalation does not consist of the valuable gases; it is a mere evaporation of the water contained in the dung. The same hot haze may be seen flickering over a fallow field in a sunny day in summer. Nobody could with truth assert, that this haze arises from the disengagement of the gases in the dung which had previously been inserted into the soil, when it is clearly nothing more than the evaporation of the moisture in the soil. In Saxony, hay is made by heaping together the cut grass, fermenting it for a short time, and afterwards drying it in the sun: but in this process, nobody would say that the nutritious portions of the grass are dissipated, when it is only the superabundant aqueous portions of the grass which are driven off by heat. To say, therefore, the first stage of decomposition in a dunghill throws off "the most valuable and the most efficient" parts of the dung, is just to say the vapour of water is the most valuable part of dung.

It is true, were the fermentation continued after all the water in the dung was evaporated, a considerable increase of temperature would ensue; and when the texture of the fibrous portions of the manure began to decompose, there would be an evolution of valuable gases. Direct experiment has proved the escape of gases from a heap of dung which has been long fermenting. But what harm accrues to the dung as a manure, from the escape of these gases? None whatever. We are told these gases constitute the food of plants; and if they are permitted to be dissipated by decomposition, the quantity of nourishment in the

heap of manure will of course be so much diminished; that if the bulk of the dung-heap be diminished one-half or one-third by excessive fermentation, the quantity of nourishment to the crops will be diminished in a greater ratio. These cautions have long been whispered in the ears of practical men, but they have listened to the advice with a provoking indifference. Like ducklings when they first take the water, they have continued to disregard every remonstrance of their foster brethren against injurious practices, raising and devouring their food, and enjoying themselves with the greatest complacency in their vocation. It is true, and we must admit it, that some of the gases constitute the food of plants; but it does not follow that plants would receive them as food directly as they are disengaged from a fermenting and heated mass; nay, it is probable they would rather reject the food that would injure them. But as plants are not endowed with locomotive powers, they cannot avoid the food which is directly presented to them; they will therefore be obliged to partake of it even in an injurious state, and in thus taking it they die. Accordingly, we invariably find that plants suffer from the contact of fermenting dung, and it is this well-known fact, more than any other circumstance, which deters farmers from applying dung in an unprepared state. It is sometimes applied to the soil, it is true, in an unprepared state, but long before the crop is brought into contact with it, and after it has undergone fermentation in the soil. Though this application of dung is recommended by men of science, it is performed from the very opposite principle which they recommend. They recommend it because the gases arising while the dung is fermenting, are absorbed by the soil, and are thence given out for the use of plants; on the other hand, farmers perform it because the fermentation will have ceased before the crop is inserted into the ground. Which of these is the more rational reason? The practical one undoubtedly; for it is surely impossible that the

slight covering of earth upon the dung can prevent the escape of the elastic gases, however it may retard fermentation.

We may conclude from analogy, that plants, like animals, have a mode of consuming their food peculiar to themselves. They may not necessarily consume the food in the state we choose to prepare it for them. All they require, is, that the materials which supply their food, shall be placed in the soil in the state least injurious to them, and within their reach, and they will feed themselves. Now, what is the least injurious state in which dung can be presented to any crop? Experience has always said in "a soft cohesive mass." Recent discoveries shew that practice has always spoken in accordance with science. Consequently, this recent occurrence of science is a tardy justification of practice.

The history of the recent discoveries alluded to, which shew the scientific accuracy of practice in applying dung in a rotten state, is this. In 1802, the celebrated chemist and analyst Klaproth, received from Palermo a substance which exuded spontaneously from the bark of a species of elm. To this substance Dr. Thomson gave the temporary name of *ulmin*. It dissolves speedily in a small quantity of water, in which respect it is like a gum; but when the solution is very much concentrated by evaporation, it is not the least mucilaginous or ropy, nor does it answer as a paste. In this respect *ulmin* differs very essentially from gum. When a few drops of nitric acid or of solution of chlorine are added to the solution, it becomes gelatinous, which, when slowly evaporated to dryness, and treated with alcohol, and again evaporated, leaves a light brown, bitter and sharp resinous substance. Thus, it appears that ulmin, by the addition of a little oxygen, evolved, either from the water of the solution by the agency of the chlorine, or from the nitric acid, is converted into a resinous substance. In this new state it is *insoluble* in water. This property is very singular: that a substance

soluble in water should assume the resinous form with such facility is very remarkable.* Berzelius has found this curious substance in all barks; Braconnot has obtained it from saw-dust, starch, and sugar. But, what is more to our present purpose, Sprengel and Polydore Boullay have found it to constitute a leading principle in all soils and manures. Sprengel appropriately calls it *humin*, from its existence in all soils, *ulmin* being given to it by Dr. Thomson several years ago as a temporary name.

Such is the history of this remarkable substance, which performs so important a function in the action of putrescent manures, and which is found in abundance in the "soft cohesive mass" of rotten dung. Let us see how it operates in manures.

The chief food of plants consists of the carbonic acid gas and ulmin, or, as it has been termed by Boullay, ulmic acid, mixed with water. Every manure is therefore only valuable which contains these substances in the greatest degree, and in such a state as they are most easily available to plants. Now, practice recommends the rotting of every kind of dung, whether simple or compounded, and the reducing it into a uniform dark-brown "soft cohesive mass," similar in consistence to fresh peat, so that it may be cut with the spade; because it maintains that dung in this state is much more valuable to crops than fresh dung or mere litter, whatever may have been the quantity of carbonic acid gas which had evolved during its fermentation. Recent discoveries have proved the wisdom of this recommendation of practice, because they have proved that rotted dung contains much more carbonic acid gas and ulmic acid, weight for weight, than fresh dung. There is, it is true, a loss of bulk in rotting fresh dung, and of an evolution of carbonic acid gas during its fermentation; but the question is not what the volume of carbonic acid gas alone is in dung, but what is the most available state in which the carbonic

* Thomson's Chemistry, vol. iv. p. 696—7.

acid gas in the dung can be presented to plants; and this is the rotted state, because in that state alone it contains the ulmic acid in quantity. All the black carbonaceous matter in dunghills, is the ulmin ready to be converted into ulmic acid, which is, in fact, the cooked state of the food of plants. Moreover, practice finds that fresh dung is injurious to vegetation; and recent discoveries now inform us that this arises from the acridity of the ammonia, which is always present in unfermented dung. Fermentation drives off the acrid ammonia. Fresh dung is found to injure plants by *burning* them, which is a very appropriate term to describe the action of ammonia. In like manner, stale liquid manure is not so good a top-dressing to grass as fresh, or when it is largely mixed with water; because, as science now informs us, that ammonia becomes concentrated in stale liquid manure, and is therefore in an injurious state for plants; and that it is necessary to mix liquid manures largely with water, in order to dilute the ammonia, and allow the proper action of the ulmic acid, which exists in large quantity in them. Again, it is not an uncommon practice to cover a dunghill with earth in hot weather, and this is now explained, not as it hitherto has been, that the earth absorbs and prevents the escape of the carbonic acid gas, which it could no more do than a balloon made of gauze could prevent the escape of hydrogen gas; but that a violent fermentation in the dung is checked by the earth partly excluding the atmospheric air and rain water, the oxygen in either of which is indispensable to continue the process, it being this oxygen which forms the carbonic acid gas by uniting with the carbon of the dung. The necessity of checking a *violent* fermentation in a dunghill which contains a large portion of horse-dung, is to prevent it being what is technically called "*fyrefangit,*" a state of dung which is useless.

In regard to composts, it is found, that to mix lime with fresh or rotten dung, is to waste it, because, as is

now explained, the lime takes up and renders useless the carbonic acid gas which they contain. In like manner, a compost of fresh dung and weeds, green leaves, grass, turf, and green vegetables, without lime, is valuable, because all these substances supply abundance of *ulmin*. On the other hand, lime promotes the fermentation of peat-earth, dry leaves, and every thing which contains hard woody fibre, and supplies *ulmin* in quantity.

It is requisite to attend to the seasons of manuring. Dung, in any state, is never applied to the land in winter; it is best applied in spring: it is injudicious to expose it to a hot sun in heaps; and it is improper to allow it to remain a length of time in heaps on the field. These practices are now easily explained, and are quite in accordance with science. In winter there are no crops in the field to which the dung can be applied: in spring, on the other hand, plants and seeds are ready to shoot forth into life; their roots are then most active to devour the nourishment which may be placed within their reach. To spread out rotted dung in hot weather, and let it lie, must be to subject its component parts to the highest degree of evaporation; and to allow it to remain in large heaps for a time on the ground, is to give the portions of the ground which are covered by the heaps an undue advantage.

We thus see that science now agrees with that practice which has been pursued for years with unexampled success. It is consolatory to practitioners to think that their experience, though unknowingly to them, has guided them to success on really scientific principles. This agreement of experience and science should teach every one that science *and* experience, and not science alone, ought to be made the tests to try the accuracy of opinions. Unfortunately for the credit of science, the test of accuracy, hitherto, in the application of putrescent manures, has not been submitted to practice. It is always for the interest of practice, however, to listen attentively to the suggestions of science. One of these suggestions, as a

rule to try the value of all sorts of manures, is, that they shall be judged by the proportion of carbonic acid gas and ulmic acid they contain, or may evolve after they have been applied, and also by the quantity of water which they are able to take up and retain. The rule, when confined to carbonic acid gas and water, was supposed to lead to a correct view of the subject, independently of ascertaining the proportion of ulmic acid. But when the rule was confined to these substances before the discovery of the importance of the ulmic acid, we see the errors which even men of science fell into. Knowing now the effects of the important principle of ulmic acid, it ought to be strictly retained as a term in the rule; because, were the ability to retain water alone taken as a test, bog-earth, the most steril substance in an undecomposed state, might be decided to be the best of all manures; and were the evolution of carbonic acid gas alone taken as a test, chalk should be an excellent manure,—and so it would always be could it be brought to take up and retain enough of water to dissolve a portion of it, which it can do by means of the ulmic acid. Now, let us apply these tests to rotten dung. There can be no question that rotten dung is very much superior in imbibing and retaining water, to that which is fresh, unfermented, or beginning to ferment. A simple experiment can easily prove this to those who doubt the fact.—*Quart. Journ. of Agriculture.*

Method of dressing Skins practised in Marocco.—The following account of the method practised in dressing skins in Marocco, was transmitted to the Zoological Society by W. Willshire, Esq., a Corresponding Member of that Society, in a letter dated Mogadore, May 5, 1833. Its results are stated to be excellent, as regards the preservation and colour of the fur, and the flexibility of the pelt.

Wash the skin in fresh water to deprive it of the salt; as soon as this is done, scrape the flesh off, when take two pounds of alum, one quart of buttermilk, and two or three

handfuls of barley-meal, which mix well together, and lay on the fleshy side of the skin equally; fold up and press it together carefully, and let it lie two days. On the third day take it to the sea-side, wash the skin well, and when clean and free from the mixture, hang it up to let the water run from it: then take two pounds of alum finely powdered, and throw or spread it equally on all parts of the skin; again fold up as before, and allow it to lie three days, when it will be in a proper state to dry in the sun, laid flat, without taking away the powder. When it is dry, take a pint or two of fresh water, and sprinkle it upon the skin, and again fold it up carefully for about two hours, to imbibe the water; then lay it on a table, and, after scraping it free from the mixture and flesh, take a sand-stone (rather rough) and rub the skin well until it becomes soft and pliable, then hang it in the shade to dry. The process is then complete.

When the skin is perfect, having the head, horns, &c. take off the horns and fill their cavity with a mixture of equal parts of powdered alum and ashes of charcoal dissolved in water, and expose them two days to the sun. Saturate the trunks of the horns with eight ounces of alum dissolved in water, and fold up with the skin, and apply the same on each occasion when employed in curing the skin. The flesh on the head and jaws to be carefully taken off, filling the same with powdered alum. It should remain in the sun until perfectly dry.

In addition to the foregoing description of the mode used in Marocco, in dressing skins, as related by the persons employed by Mr. Willshire, it may be well to observe, that the process does not take so long at Mogadore, as Mr. W. has often received back skins of the Aoudad and Leopard from the dresser, on the third or fourth, and never exceeding the fifth day, perfectly cured. Allowance has been made by the dresser, in the foregoing description, for the difference in the climate of London.

The skins of smaller animals must not be subjected to

so lengthened a process, or they will become harsh, and the pelt impoverished.—*Proceedings of Zool. Soc.*

ALLEGED DISCOVERY OF COAL AT BILLESDON, LEICESTERSHIRE.—In the Repertory for October, we inserted a notice on this subject by Mr. Holdsworth, which had appeared in the Philosophical Magazine: we now give an important commentary upon that notice from the same source, by that eminent geologist, the Rev. W. D. Conybeare.

The "*Notice of the Discovery of Coal-Measures, at Billesdon, Leicestershire,*" strongly illustrates the misunderstanding, so much to be regretted, that is often found to prevail in the minds of those engaged in practical researches, with regard to those generalized views of science, which are the only guides of really effective inquiries, but which are by such persons hastily thrown aside, under the entire misconception that they are founded only on data purely theoretical; whereas, in fact, the general views of systematic science are necessarily, wherever they are just, founded primarily on an extensive induction from practical observation alone. They present, indeed, merely the combined and condensed results of the very widest practical observation, divested only of the very obvious cause of error which a narrow spirit of judging from mere local acquaintance with a single district, must necessarily introduce.

Thus in the notice which has occasioned these remarks, Mr. Holdsworth announces the discovery of coal-measures at Billesdon, without any thing like a precise description of the thickness, range, or extent of a single bed of coal, and relying only on washing from the materials produced by boring, which, after all, are so loosely described, that it seems very probable that they may be nothing more than fragments of fossil wood, known to be very common in the lias formation, instead of true coal. In like manner the fossil vegetable remains, mentioned by him, are described only under the old and vague name of Carpolithes,

without any indication which can enable us to judge whether they belong to the species usually associated with the regular coal-measures or not. The notice is also destitute of every thing like a general account of the geological relations of the district; and it is hastily assumed that scientific geologists would previously have pronounced against the possibility of the occurrence of any coal in that neighbourhood, although the slightest acquaintance with any standard work on geology would have informed Mr. Holdsworth, that, besides the principal carboniferous formation, others are recognized, especially that connected with the sands of the inferior oolite, in the eastern moorlands of Yorkshire, and at Brora in Scotland. Now it so happens, that these very sands of the inferior oolite, assuming a character very similar to their type in Yorkshire, range from Belvoir along the eastern portion of Leicestershire, and skirt on Billesdon itself. It seems, therefore, by no means improbable, that if Mr. Holdsworth has really found any coal, it may belong to this formation; but his description does not at all state whether the site of his discovery be in these sands, or in the subjacent lias.

When also the general geological structure of Leicestershire is considered, no scientific geologist, assuredly, would have ventured to pronounce it highly improbable, that, by piercing the lias itself, the great carboniferous measures might have been reached in the neighbourhood of Billesdon, since, in no very distant portion of the same county, we see the older transition rocks of Mount Sorrel bursting forth in immediate proximity to the lias of Barrow-on-Soar. In like manner it is easy to suppose that some great undulation of the inferior strata may throw up the great coal-measures beneath the lias at Billesdon. Under very similar circumstances coal is found throughout the great coal-field of Somersetshire: at Newton, near Bath, for instance, it is largely worked in

the very midst of a lias district; but whether any similar circumstances exist near Billesdon, we are left in total ignorance.

These are the points which require to be examined into, in order to give the experiment now conducting at Billesdon the slightest probability of success; without such investigation, it can only end in disappointment and loss. —*Lond. and Edinb. Phil. Mag., Aug.* 1833.

Since preparing the above for insertion in our pages, we have been informed, that at a recent meeting of the Cambridge Philosophical Society, Professor Sedgwick gave an account, illustrated by maps and sections, of the geological structure of Charnwood Forest, in Leicestershire, and of the neighbourhood; in the course of which he observed, that the secondary strata in the vicinity of this group of primary rocks, appear in a very regular and undisturbed position, the new red sand-stone, lias, and oolites succeeding each other in the usual order; that, therefore, the attempt so recently made to obtain coal by sinking through the terrace of Billesdon Coplow, the outcrop of the inferior oolite, must necessarily prove unsuccessful. We hope to add some further information on this subject in our next Number.

IRON-STONE OF SUSSEX. This substance was formerly extracted from the ferruginous sand-stone strata; it is internally of a dark steel grey, and generally very hard and compact; occasionally it is laminated, and separates into thin flakes upon exposure to the air. It occurs either in irregular concretions in the sand [of the *Hastings' Sand* formation of geologists, formerly called the *Iron Sand*,] or it is stratified and alternates with beds of sand-stone. The globular masses often contain nodules of argillaceous earth, round which the iron-stone is disposed in concentric layers. In some parts of the county the iron-stone is of excellent quality, and extensive founderies were anciently established in different parts of its course; "the almost inexhaustible quantity of wood," we are informed, in Dallaway's

Western Sussex, "with which the country was covered in the early centuries, and the numerous lakes and morasses which the total neglect of drainage had occasioned, being circumstances peculiarly favourable for the conversion of the iron ore into bars. For this purpose the lords of the several manors which lay within the woodland district, collected the rivulets into large ponds, and erected mills and furnaces. The iron, so procured, was at first principally used for agricultural implements;" but Fuller also observes in his Worthies, that "it is almost incredible how many great guns were made of the iron of this county. The total decline of the manufacture in Sussex is to be attributed to the establishments in Scotland and Wales, in which pit-coal is used, the superior cheapness of fuel having enabled them to monopolize the trade." There is now but a single foundery in the eastern division, and which belongs to the Earl of Ashburnham. According to the present practice, it requires fifty loads of charcoal, and fifty loads of iron-stone (twelve bushels to each load) to make thirteen tons of pig-iron.—*Mantell's Geology of the South-East of England.*

CRITICAL NOTICES AND REVIEWS.

The Caloric Engine. By J. Ericsson. An unpublished pamphlet.

It has become a common practice with individuals, when they have secured their inventions by patents, to publish a book or a pamphlet setting forth the merits and principles of their inventions. The system may be said to be a good one—for too much publicity cannot be given to a valuable invention, nor too much reward be obtained by the inventor, so long as that reward is a part only of the savings which are produced to the country by the application of any new means of manufacture,

or of any better means of actuating the machinery which produces manufactures; whilst, on the other hand, the extensive publication of a supposed valuable invention, will more quickly produce inquiry into its construction; its value will be tested, and the want of merit will bring it quickly into oblivion.

From the time that Watt succeeded in maturing the steam-engine, one common desire appears to have been felt by a particular class of individuals, to strike into a new course of experiment; feeling, we suppose, that the steam-engine no longer offered the possibility of obtaining so brilliant a reward as a *power* produced by different elements. Consequently, the propositions for producing *motive power* are more numerous than any other class of projects; and from this source many inventions of value may be expected, though probably very many more failures. The invention now before us, has for its object the superseding the use of steam, by substituting expanded atmospheric air.

Since we have undertaken the editing of the Repertory, we have avoided making critical remarks on any of the numerous inventions which come before us; and it is only when called upon to step out of our usual course, by the receipt of a pamphlet, as in the present instance, or by some cause equally moving, that we are willing to place our opinion before the scientific world, in respect to any invention; and although we have been invited to this subject several times by our readers, owing to the "Caloric Engine" having made considerable noise in the world, we have withheld our opinion, being desirous to obtain the fullest information on the subject, and not to depend on the mere reading of the specification for forming our judgment. The application of expanded air for producing motive power is not in itself a new proposition, neither does Captain Ericsson put forward any such claim; on the contrary, many experimental engines of this description have before been made, and Capt. Ericsson was him-

self, some years ago, interested in one that was erected, we believe, near the docks*, which was, at the time, said to be as likely to supersede all other means of producing power, and induced Dr. Arnott, when writing his second volume on Natural Philosophy, to express himself most strongly in favor of expanding air for producing power, in place of employing steam. This had before been a favorite subject with the Doctor, he having obtained a patent for an air-engine. In his work he devoted many pages to prove that any given quantity of fuel used to expand atmospheric air, would produce four times the quantity of power as if applied to convert water into steam; and yet —these engines passed away—without bringing into being others of the same family.

The present engine may be readily described; it consists of two cylinders, one being termed the *hot air or working cylinder*, which is fourteen inches diameter†; the other being called the *cold air cylinder*, which is ten and a quarter inches diameter†; each having a stroke of eighteen inches. These two cylinders are constructed similar to the cylinders of a steam engine, having induction and eduction ways, with ordinary slides for reversing the passage of the air to and from the two sides of the pistons. Each cylinder has an ordinary piston and a piston rod, which, by being affixed to either end of a beam, will be actuated simultaneously, the *hot air cylinder* by the expansion of the air, and the *cold air cylinder* by the action of the other end of the beam; the *cold air cylinder* performing the office of withdrawing the air from a vessel called the "regenerator," to make room for the hot air from one side of the piston of the *hot air cylinder*, when it has performed its office, and then forcing a quantity of air through the furnace to become heated to act on the other side of the piston in the *hot air cylinder*, the cylin-

* By Count De Rosen.

† We give the dimensions because the calculations hereafter given have reference to them.

ders being double acting, the two operations are simultaneous. But thus far there is no claim of invention; the point of novelty is in placing a refrigerator between the *hot air cylinder* and the *cold air cylinder,* which the inventor has called the "regenerator;" it consists of an outer cylinder or vessel, between seven and eight feet long and eight inches in diameter. This vessel contains seven pipes, two inches in diameter. The long cylindrical vessel is divided into three parts, that is, the two ends are divided off by partitions through which the seven internal pipes pass, and thus open a way between the two ends of the regenerator; it will thus be evident that any air passing into one end of the regenerator will pass through into the other end of the regenerator by the internal pipes; but such air, cannot get to the body or main part of the regenerator, till it has passed through the *hot air cylinder.* The *cold air cylinder* is connected, by means of a pipe, to one end of the "regenerator," and another pipe from the other end of the "regenerator," is connected with a series of small tubes, which pass over a furnace and open into the induction pipe of the *hot air cylinder;* the eduction pipe from this hot air cylinder opening into the body of the "regenerator" in such manner, that the hot air, after having performed its duty of actuating the piston, is intended to give off its heat to the air which is being driven through the internal pipes towards the fire. It should be stated that in order to prevent the hot air at once passing to the full extent of the "regenerator," there are partial partitions which cause the air to take a circuitous zig-zag course. From the other end of the "regenerator" a pipe connects the outer vessel with the *cold air cylinder;* such pipe first passing through water to give off any heat which the air may contain when it arrives at this stage, so that it may pass into the cold air cylinder as cool as possible. The inventor also proposes that the seven pipes contained in the "regenerator" should also have partial division plates, alternately above

and below, to cause the air continually to change its direction.

We believe the inventor will do us the credit to say that we have fairly described the nature of his combination. We will now permit him to speak for himself in describing the action of the machinery. He commences by stating that

"The leading feature of this engine, and which distinguishes the same from all other machines hitherto constructed for the purpose of obtaining mechanical power by the agency of heat, consists in this, that the heat which is required to give motion to the engine at the commencement, is returned by a peculiar process of transfer, and thereby made to act over and over again, instead of being, as in the steam-engine, thrown into a condenser, or into the atmosphere as so much waste fuel.

"The well-known phenomenon, that temperature, or quality of heat, is always equalised between substances, however unequal they may be in density, forms the basis of this new application of heat. But, previous to entering into the details of the caloric engine, it will be proper to give due consideration to its important aim, viz.—That of producing a given quantity of mechanical force by a quantity of fuel so small, as to form only a fraction of that which has been stated by eminent experimentalists as the minimum.

"Several experiments which have been made tend to prove, and it is pretty generally acknowledged as a fact, that a given quantity of heat imparted to any gaseous body, will produce an equal quantity of mechanical force by the dilation which it causes. And the most accurate experiments prove, that the combustion of one pound of the best coal is only capable of raising the temperature of 9000 lbs. of water one degree.

"On these grounds the author of the best treatise on the steam-engine, has ventured to assert, that 'we have little to expect in the form of improvement;' *—and he shews, by a set of tables, that an engine employed, for instance, in giving motion to the shaft of a mill, will consume from 7½ to 8 lbs. of fuel in the hour for every horse's power constantly imparted to that shaft.

"In thus predicting limits to any further improvement, due consideration was, no doubt, given to the fact, that the heat which gives motion to a steam-engine is still in active existence after having performed its duty in the cylinder; but the importance of that fact was probably passed over, because the heat imparted to the condensing

" * See Tredgold's Treatise on the Steam-Engine, p. 118."

water, although in *quantity* the same as previous to causing the motion of the piston, its *quality* is altered, viz. brought to a lower temperature, and thereby unfit for being carried back to the boiler to assist in raising a fresh supply of steam. But this circumstance of the heat being continually transmitted to the condensing water in the steam-engine, proves its principle to be a direct misapplication of heat in producing mechanical force."

We would remind the author that many of the Cornwall steam-engines are constantly raising from sixty to eighty millions of pounds one foot high by the consumption of every bushel of coals; if, therefore, he expects to supersede the steam-engine, he must be able to shew that his "caloric engine" is capable of performing more than the Cornwall steam-engines with the same expenditure of fuel. We must confess that we do not understand what the writer means by the "*quality*" of the heat in steam being altered. If he means that some part of the heat has been taken up by the condensing water, we should understand him; but this cannot be fully expressive of his meaning, for he goes on to say, that the heat is "*unfit* for being carried back to the boiler to assist in raising a fresh supply of steam." Now we have always understood that the larger the quantity of heat which is contained in the water pumped back into the boiler the less fuel is required to convert it again into steam; besides the condensed steam is pure water, containing no earthy matters, and is the most desirable to be used over again. However it is not necessary that the inventor of an air-engine should be thoroughly acquainted with applying heat to produce steam; but he ought to have it strongly impressed upon his mind that by withdrawing heat from steam in the condenser, a vacuum is produced behind the piston, and this advantageous effect cannot be produced when using air; neither can the volume of air be readily lessened when once expanded; it must therefore be an obstruction to the power on the other side of the piston:—but more of this anon. To proceed with our extract—

"By reflecting on the nature of heat. it will become evident that there is nothing in its properties to prevent a given quantity once generated or excited from producing a continuous and but slightly diminishing force by its dilating influence; for, if fluids contained in a vessel divided by a metallic partition, with a passage at each end, be heated towards one extremity, and then put into motion in contrary directions, their particles will, merely by the transfer of the same heat through that metallic partition, successively repel each other with greater force as they approach the heated extremity, and with gradually less force as they approach the cold extremity of the vessel; or, in other words, the fluids made to circulate will continually dilate when at the one end, and contract when at the other end of the vessel. By the caloric engine, consisting of a peculiar combination of pistons and valves, this constant dilation and contraction is employed for giving motion and power to machinery, without requiring any other additional supply of heat or fuel than what will make up for losses caused by radiation, and for the loss of heat which is occasioned by the circumstance that substances which are in a compressed state have not so great a capacity for heat as when they are less dense."

The writer appears to have forgotten a very well understood property in pneumatics—that is, atmospheric air, when contained in a closed vessel, if pressed on at any one point will instantly equalize that pressure in every direction, so that one part of the air will not remain more dense than another, and we suspect a very similar result will be found to take place in the "caloric engine."

"The vessel by which the transfer of the heat is effected, the inventor calls the 'Regenerator,' since within this vessel power may be said to be thus far regenerated that its source the heat, which in former engines is continually wasted, is by this apparatus preserved or brought back to perform the same duty over again.

"By the following description it will become evident that the impelling agent, or circulating medium, in the caloric engine, may consist of various aeriform or fluid substances, capable of considerable dilation by heat. But atmospheric air will probably be found the best in practice, since in case the apparatus should happen to leak, the loss caused thereby may be so easily replenished by taking any required fresh supply from the atmosphere.

"Previous to describing the action of the engine, let us suppose that the stove, with its pipes, and the working cylinder, have been heated, and likewise the regenerator with its tubes, to be brought to the same temperature nearest to the stove, gradually lessening, so as

to be at the opposite end equal in temperature with the surrounding atmosphere."

"It becomes evident that if air be forced or pumped into the caps of the regenerator until it has attained any given pressure, it will, on the one hand, find its way through the stove-pipes, &c. into the top-part of the hot cylinder, on the other hand, through the pipe, into the top-part of the cold cylinder; but the hot cylinder being larger (say double the size) of the cold cylinder, it naturally follows that the power of the piston, will overcome the power of the smaller piston, and make it ascend, itself at the same time descending. Thus motion will commence, and by reversing the position of the slide-valves when the pistons have performed their full strokes, the motion will be kept up without any further charging.

"The action of the engine, and the transfer of the heat, will at once be understood. The piston, of the hot air cylinder, being supposed in the descent, it will be seen that the hot air from the lower part of the hot cylinder escapes under the lower slide-valve through the pipe, into the body of the regenerator, and the piston in the cold being on the ascent it draws the air from the body of the regenerator through the cooler, entering under the lower slide-valve of the cold air cylinder, at the same time the air above the piston, in that cylinder, is forced through the tubes, to the stove-pipes, into the top part of the hot cylinder. Thus the two cylinders are made to supply each other; but the hot air entering the body of the regenerator, will, by the peculiar arrangement of the divison-plates, make a very circuitous passage, and by having its particles constantly intermixed, readily give out its heat. The cold air entering the tubes, from the cold air cylinder, will also, during the passage, have its particles rapidly intermixed by the metallic discs, and thereby readily take up the heat given to the tubes by the opposite current, and accordingly become heated.

"The transfer of the heat being thus explained, it need hardly be stated that the object of the stove is, besides that of heating the apparatus at the commencement, to restore that heat which will unavoidably be lost by radiation and in the transferring process. And the object of the cooler is that of abstracting any heat from the circulating medium which has not been taken up in the regenerator, that it may enter the cold cylinder at the lowest temperature possible.

"By charging the engine with air of greater density, its power will of course be increased. It is true that by increasing the density in the tubes, &c. the density in the body of the regenerator will also be proportionally increased; *still by keeping the temperature of the air that enters the hot cylinder about* 480° *higher than the air that leaves the cold cylinder, the pressure in the seven pipes will always remain nearly*

*double that of the pressure in the body of the regenerator**, provided the motion of the slide-valves be adjusted in accordance with the principle of the action of the engine. In practice it will be found quite impossible to preserve the pressure in the engine without a constant supply from without; a pump will therefore always be attached to the engine, constantly charging the pipes of the regenerator: and to prevent over-charge, a safety-valve is attached in some convenient place for carrying away the surplus.

"*By keeping the pipes in the regenerator so charged with air as to support a column of mercury* 56 *inches high, the greatest effect is produced in the trial engine. By the manner in which the slide-valves are worked, the pressure in the body of the regenerator always adjusts itself, so as to support a column of mercury* 18 *inches high; so that an effective pressure, equal to* 38 *inches of mercury is kept up. A break, well oiled and loaded, with* 5,000*lbs. weight acting on the circumference of a wheel of two feet diameter, fixed on the fly wheel shaft, will, at the above pressure, keep the speed of the engine at* 55 *revolutions per minute. At this speed* 176 *cubic feet of heated air, of a mean pressure of* 17*lbs. to the square inch, are admitted into the working cylinder per minute, thereby exerting a force equal to* 431,970*lbs. moved through the space of one foot: thus* $\frac{431,970}{33,000}=13$ *horses' power are communicated to the main crank of the engine. The estimating this power is, however, of no other use than to give an idea of the amount of friction to which the crank-engine is subjected. In the same space of time, or a minute,* 94.6 *cubic feet of cold air of a mean resistance of* 14*lbs. to the square inch, are forced or put into circulation by the cold cylinder, and equal to a resistance of* 190,575*lbs. moved through the space of one foot. This amount, divided by* 33,000 *will give* 5.7 *horses' power required to work the cold cylinder—hence the two cranks give and receive the power of upwards of* 18 *horses. By communicating the power of the hot cylinder to the cold cylinder in a direct manner, the available power, setting frictions aside, would be* 431,970—190,575=241,395 *lbs. moved through the space of one foot. This is equal to* $\frac{241,395}{33,000}=7.3$ *horses' power—deducting* 2.3 *horses for frictions would leave* 5 *horses. On these grounds the trial engine has been estimated at* 5 *horses' power.*

"The transferring process has succeeded to such an extent that out of the 10 lbs. of fuel which the engine consumes per hour, the product of heat from 3 lbs. of fuel only are wasted or carried away by the cooler —this important fact has been ascertained by immersing the cooler in a cistern containing precisely 1081 lbs. of water, and by observing the elevation of temperature after an hour's work of the engine; and the

"* By pressure is here meant the absolute pressure on a vacuum."

increase of temperature in that time is not quite 20 degrees—one pound's weight of fuel being capable of raising the temperature of 9000 lbs. of water, it follows that the 1081 lbs. contained in the cistern would be raised 8.3 degrees by the combustion of 1 lb. of fuel, and hence that the actual increase of 20 degrees of temperature is effected by the combustion of less than 3 lbs of fuel. The great discrepancy between the quantity of fuel thus wasted, and that actually consumed by the engine, must be accounted for by the fact, that a considerable extent of radiating surfaces are exposed to the cooling influence of the atmosphere without being surrounded by any imperfect conductors.

"What may be expected from an engine of a large scale, and in which the loss of heat by radiation is carefully guarded against, need not be pointed out."

We have now put our readers in possession of the whole of the pamphlet, and we have printed some of the main points in italics, to which we would more particularly wish to call their attention. If the caloric engine is to stand or fall on the correctness of the pamphlet, it will not require many degrees of foresight to predict the result. The writer states, that the air being kept 480 degrees higher in the pipes which pass through the "regenerator" than it is in the cold air cylinder, will always *remain nearly double the pressure* of the air in the body of the "regenerator;" that is, the air which has come from the *hot air cylinder*, and has only just passed through the furnace, is, in about a second of time, become colder and of less pressure than the same quantity of air which has been simultaneously forced from the *cold air cylinder*. This, we do not hesitate to say, is erroneous; and we would advise the inventor to place a mercurial gauge in the body of the "regenerator," and he will find that we are correct. This gauge would also have another desirable effect: it would indicate the quantity of pressure which is at all times acting at the back of the piston in the *hot air cylinder*, which it is most material to know, for this reason, the difference, of the column in the mercurial gauge on the induction pipe and the column in the gauge on the body of the "regenerator," will more correctly shew what quantity of

expansive force is really actuating the working cylinder. Again, in respect to the 480 degrees, if the air in the apparatus, prior to its being heated, be of equal density with the outer atmosphere, this temperature will nearly double the expansive force of the air so heated, and will raise the column of mercury in the gauge of the induction pipe to about 56 inches, or at a pressure of about 28lbs. on the square inch of a vacuum. This we will suppose to pass into *the working or hot air cylinder*, to produce the first or up stroke of the piston. The slides being then reversed, this quantity of air, whilst at its maximum of heat and pressure, is to be driven from the hot air cylinder into the body of the "regenerator." And here we must ask at what pressure this will be effected? The inventor says at a pressure of 18 inches of mercury, which he states will be the pressure existing at all times in the body of the "regenerator." This, to say the least of it, must be most erroneous. A mercurial gauge on the body of the "regenerator" would indicate a column of about 30 inches even when the air therein was only at the density of the atmosphere. The working of the cold air cylinder would withdraw a quantity of air from the body of the "regenerator," which would be simultaneously replaced by hot air from behind the piston of the hot air cylinder. The heat and pressure of this hot air would be quickly diffused over the whole of the air remaining in the body of the "regenerator," and some of the heat would, as a matter of course, be communicated to the air passing from the cold air cylinder through the seven pipes which pass through the "regenerator" to the furnace, so long as the air passing through those pipes has less heat than that contained in the body of the "regenerator."

We never remember to have seen so many errors contained within so few lines of print—every step we take opens a fresh field for correction. The next point which strikes us with surprise is the idea of there being a power of 13 horses communicated to the main shaft of the en-

gine, though the inventor does not take credit to his engine as producing this as an effective power; but after certain deductions, which we shall speak of hereafter, he tells us that the whole effective power is only equal to 5 horses; thus, according to his own account, losing 8 horses power by friction caused by the working of the various parts of the engine: — this calculation, like the rest, is fallacious. We will, however, bring the figures again before our readers. The inventor states that the engine makes 55 strokes per minute at a mean pressure of 17 lbs. on the square inch, how this mean pressure is obtained we know not, for he has not condescended to explain; these 17 lbs. on each square inch of the piston are equal to 431,970 lbs. raised one foot high, equal to 13 horses; the author observing, that "*the estimating this power is of no other use than to give an idea of the amount of friction to which a crank engine is subjected.*" But let us see further what is said on the power and the loss of power by this engine. The piston in the cold air cylinder also making 55 strokes in the minute, is said to be subject to a mean resistance or pressure of 14 lbs. to the square inch, between 5 and 6 horses' power to be deducted from the before-mentioned 13 horses' power; a further deduction of 2 horses' power is also made for friction, bringing down the effective force of the engine to *five horses.* We suspect that if four-fifths more were deducted the engine would then not be found to perform its calculated work, for there is no mention made of the quantity of resistance at the *back of the piston in the hot air cylinder,* other than the simple observation that the air in the body of the "regenerator" will support 18 inches of mercury, though by some magical effect the piston in the cold cylinder is said to be worked at a mean resistance of 14lbs. on the square inch, equal to a column of about 28 inches of mercury; and yet the cold air cylinder is open to the body of the "regenerator."

We will, in conclusion, sum up the principal of our

objections to the propositions contained in the pamphlet, though some of our readers will probably think there are other parts equally deserving animadversion. *First*, the air in the body of the "regenerator" must always be capable of supporting a column of more than thirty inches of mercury, supposing the engine to commence working with air of the same density as the outer atmosphere; the author is wrong in stating it to support only eighteen inches of mercury. *Secondly*, the hot air, after it has actuated the piston in the hot air cylinder, will, on coming into the body of the "regenerator," impart its heat and pressure to the remaining air, and quickly equalize the pressure in all directions, a very small quantity of heat would be transmitted to the air in its passage from the cold air cylinder to the furnace. *Thirdly*, the air, on being forced from the cold air cylinder through the pipes to the furnace, will, as it becomes heated, re-act against the piston of the cold air cylinder. *Fourthly*, no allowance has been made for the re-action of the air behind the piston in the hot air, or working cylinder, although the air is at its maximum of heat and pressure, and has to be forced through small orifices (technically called wire drawn) into the "regenerator," which is already under considerable pressure, and which must be greater than merely sufficient to support eighteen inches of mercury, or nine pounds on the square inch, as stated in the pamphlet.

And, now, a few words as to the engine itself. We may be told, in answer to what we have said in respect to the pamphlet, that the engine works, and has surprised many who have seen it; perhaps so, but that does not improve the value of the engine any more than it does the value of the pamphlet. We do not hesitate to say, that the present air-engine, like its predecessor, will die without issue, and that the whole power produced is the difference of pressure caused by the air passing directly from the furnace to the working cylinder; the "regenerator" being

in truth an obstacle rather than an advantage. If, as we before mentioned, a mercurial gauge were placed on the induction pipe, and another gauge on the body of the regenerator, the difference of the columns would be very immaterial, and this, putting the friction out of the question, is the only power obtained. We have said nothing of the practical difficulties of having pipes or tubes acted on by fire, which would alone be sufficient, even if the principal of the engine were good, to condemn the "caloric engine;" there is also the working of the hot air cylinder and piston at a dry temperature of 500 degrees of Farenheit; but these objections will be evident to every practical man, and need no further observation from us.

The Book of Science. A Familiar Introduction to the Principles of Natural Philosophy adapted to the Comprehension of Young People. London: Chapman and Hall.

Till within very modern times the Book of Science was sealed to the many and open only to the few;—how strangely are things changed!—The cultivation of every branch of natural philosophy, since the time of the immortal Bacon, has progressively increased the number of its students, and the very enlargement of its sphere accelerates with tenfold force the future advancement to a correct knowledge of every department of science. The present little volume is, as its title-page denotes it to be, "*a familiar Introduction to the Principles of Natural Philosophy;*" and its contents are seven well-compiled chapters on Mechanics, Hydrostatics, Pneumatics, Acoustics, Pyronomics, Optics, and Electricity, so written that, with moderate attention, a youth may obtain a very clear knowledge of each of these branches of natural philosophy. The volume is bound uniformly with the "Boys' own Book," and may be said to be a suitable successor

to that little work; and we agree with the Editor of the Athenæum, that the title of present volume would have more correctly conveyed its intent, had it been "The Boys' Book of Science;" it being more particularly adapted for the instruction of youth. The Compiler deserves great credit for the arrangement, and also for the simple, at the same time, correct, and familiar style of conveying information. We cannot do better than recommend parents to present to their children this elegant little production as a New Year's Gift.

The Sciagraphicon. London: invented by Alfred Essex.

The instrument before us is an optical illusion; and, although not new in principle, is, for its execution and design, highly deserving of attention.

The diffusion of knowledge in the various branches of science, produces even toys of a philosophical character, which are at once amusing and instructive. We have not met with any one which has given us greater pleasure than the present. It consists of a drawing of a castle, which, to the observer standing beside, and not placed in the proper point of sight, appears distorted and without correctness of form or dimensions, but when viewed through a small orifice so situated as to bring the eye into a certain position with reference to the various parts, causes the horizontal drawing to represent a castellated building, standing in strong relief, and having a most substantial appearance; the lines of the towers seem to be at right angles to the plane on which the drawing is placed,—indeed the whole is a most perfect illusion.

VARIETIES.

Reduction of the Duty on Iron imported into France.—The French Council of Commerce, at its sitting, Dec. 20th, resolved to recommend the following reductions in the import duties on iron:

Upon iron smelted with coal, or English iron, now taxed at 25 fr. for every 100 kilogrames, a diminution of one-fourth:

Upon iron smelted with charcoal, or Swedish iron, now taxed at 15 fr., a diminution of one-fifth:

Upon several species of cast iron, now taxed at 9 fr., and 4 fr. 5c., a diminution of one-fourth of each of these duties.

The council also proposed that these reductions take place immediately, and be continued for five years; and, further, that iron be imported in any quantity, instead of the merchants being compelled, as at present, to bring in at least 400 kilogrames at one importation.

Steam Carriages.—The following is a list of steam carriages and drags built and now building in London and its vicinity:—

Dance, three sent to Cheltenham.

——— and Field, one repaired and new boiler.

Frazer, a carriage, himself and others, building, an experimental one.

Gatfield & Bower, a drag, themselves, experimental one, building.

Gibbs and Applegath, a drag, themselves, experimental one, built.

——, an experimental carriage to try new boiler.

Gurney, four, experimental.

Hancock, Infant, his own, built, an experimental one.

————, Era, for a company, built.

————, Enterprize, for a company, built.

————, Autopsy, his own, built.

————, a new one, his own, now building.

Manting, Joseph, a carriage, his own, experimental one, building.

Maudslay, one, building.

Mile End, name not known, a carriage, for a company, experimental one.

Ogle, a carriage, his own, built, experimental one.

Palmer, a drag, his own, experimental one, built.

Phillips and Co., a carriage, their own, experimental one, building.

Redmund, a carriage, experimental one, building.

Silk, a carriage, his own, experimental one, building.

Smith & Co., a carriage, for a company, experimental one, building.

Smith (Andrew), a drag for Mr. King, experimental one, building.

Squire, a carriage, for himself and others, experimental one.

Liability of Steam-Engines to Poor's Rates.—A question on this point has lately been mooted at Birmingham; and Mr. Amos and Mr. Hill have given opinions affirming their liability to be rated; while Mr. Steer is of a contrary opinion. The two former gentlemen consider steam engines as hereditaments, and not personal property; but the latter ranks them as moveable fixtures. At a meeting of the guardians of the poor, however, it was resolved to exempt them; but the parishioners still purpose to contend for their liability.

Butter.—There are three distinct kinds of butter manufactured in Holland; the butter made from the cream when the cow is at the grass in summer, called *Grass Butter;* the butter from the whey of the sweet milk cheese, called *Whey Butter;* and the butter made in winter when the cows are in the byre, called *Hay Butter.*

Grass Butter.—The cows being carefully milked to the last drop, the copper pitchers lined with brass, or pitchers entirely of brass, which contain the milk, are put into an oblong water-tight pit, which they call a *koelbak,* built of brick or stone, about six feet in length, three feet in breadth, and two feet in depth, into which cold water had been previously pumped, (there being generally a pump at one end.) In this pit or cooler, the pitchers stand two hours, the milk being frequently stirred. This cooling process is of great advantage in causing the cream to separate rapidly and abundantly from the milk. Thereafter, the milk being run through horse-hair searchers or drainers, is put into flat milk-dishes of earthenware, copper, or wood; it remains in a cool milk-house or cellar, for twenty-four hours. It is then skimmed, and the cream is collected in a tub or barrel. When soured, and if there is a sufficient quantity from the number of cows, they churn every twenty-four hours, the churn being half-filled with the soured cream. A little *boiled* warm water is added in winter, to give the whole the proper degree of heat, and in very warm weather the cream is first cooled in the *koelbak* or cooler. In many small farm-houses, or when the cows give little milk, the milk is not skimmed, but the whole, when soured, is put into the churn; the butter immediately after being taken out, is put into a shallow tub called a *Vloot,* and carefully washed with pure cold water. It is then worked with a slight sprinkling of small salt, whether for immediate use, or for the barrel, there being none made entirely fresh, or without salt, as in Scotland.

After the cows have been only eight or ten days out, the difference from hay butter is slightly perceptible, but the grass butter after the cows have been three weeks at grass is found delicious. This new butter is highly esteemed in Holland, is made in fanciful shapes of lambs, stuck with the flowers of the polyanthus, pyramids, &c. and

sells as high as 44 stivers, equal to 3s. 8d. the 17½ oz. or Dutch lb. If intended for barrelling, the butter is worked up twice or thrice-a-day with soft fine salt, for three days in a flat tub, there being about two pounds of this salt allowed for fourteen pounds of butter; the butter is then hard packed by thin layers into the casks, which casks are previously carefully seasoned and cleaned. They are always of oak, well smoothed inside. Before being used, they are allowed to stand three or four days, filled with sour whey, and thereafter carefully washed out and dried. Each cow after being some time at grass yields about one Dutch pound (17½ oz.) of butter per day.

Hay Butter undergoes the same process: being of course the butter made in winter, when the cows stand in the dairy, but although inferior in flavour and colour, it has nothing of the disagreeable taste which the turnip imparts to the winter butter of this country.

Whey Butter is made from the whey of the sweet milk cheeses. The whey, being collected from the curd and the pressed cheese, is allowed to stand three days or a week, according to the quantity; the cream if either skimmed off and churned, or the whey itself, is put into churn, and the butter is formed in about an hour. In winter the butter obtained by the process is about 1 lb. per cow per week, and in summer about 1½ lb. per cow per week.

The usual proportional prices per lb. of these three kinds of butter in summer are 8½ stivers or pence for common grass butter, hay butter seven, and whey butter six, although, as already shown, the first fine spring grass butter obtains a much higher price.

A process for varnishing leather for belts, cartridge boxes, &c.— The varnish for leather is the same as that for carriages, except that it contains less copal, and that the oil used in the varnish for certain coarse articles, should be a little decomposed.

After having dressed and scraped the leather to be varnished, apply upon the flesh side a thin coat of glue water, to which has been added about an ounce of boiled linseed oil. The leather, when dried, is polished, and successive coatings applied until it becomes very smooth. Then mix one part of strong drying oil (linseed oil, with a considerable dose of litharge) and one of copal varnish, in an iron vessel, add well pulverized lamp-black and spirits of turpentine, and set the whole over a fire. The leather, which, during this time has been kept in a closet artificially heated, is now stretched upon a table, a very thin coat of the mixture quickly laid on with a flat brush, immediately replaced in the warm closet, and allowed to dry slowly: when dried it is polished with pumice-stone, or, which is better, with charcoal finely pounded and sifted. A second coat is applied in the same way, and the operation finishes with a third coat, which should

be very lightly laid on, and be very smooth. The leather is now dried without polishing.

Leather for straps, &c. is sometimes manufactured by being passed between rollers; this enables it to receive a higher degree of polish and smoothness. Sometimes the leather is stained with lamp-black mixed in glue water, and finished as we have just described. For articles which are not intended to bend, a greater proportion of copal varnish and more spirits of turpentine are incorporated with the coating mixture. These varnishes are laid on when cold.

Method of giving a black and glossy coating to cast-iron trinkets and other articles of the same material.—This composition is simple, and offers the invaluable advantage of efficaciously resisting the action of the atmosphere, and even of weak acids, so that the process may be employed for coating a great variety of cast utensils commonly used in our families. The coating easily fixes itself on cast-iron, and may also be used on hammered iron, but with less certainty of success in the latter case than in the former.

Attach each of the articles to be coated to an iron wire bent above into a hook, and apply a thin coat of linseed oil; the coat must be thin, to prevent the oil from running, forming asperities or knots where it collects. Hang them eight or ten inches above a wood fire, so that they may be completely enveloped in the smoke. When they have been thus exposed to a brisk fire for about an hour, lower them so that they shall be near the burning coals, without touching them; at the expiration of about fifteen minutes remove the articles, and immediately immerse them in cold spirits of turpentine.

Any articles, which, after this last operation, may be found deficient in brilliancy, or not sufficiently black, are to be re-exposed to the burning coals for a few minutes, and again dipped in the spirits of turpentine.

This process, which may be variously modified to suit different articles, may, from its simplicity, be extensively applied, and will prove useful in all cases in which cast utensils are subject to rapid oxydation.

NOTICE OF EXPIRED PATENTS.

Francis Fox, the younger, of Derby, Doctor in Physic; for a method of facilitating and ensuring the discharge of fire-arms and artillery of every description.—Sealed January 15, 1820.

JOHN LEBERECHT STEINHAUSER, of Moffat Terrace, City Road, Middlesex, Artist; for an improvement on portable lanthorns or lamps applicable to various purposes. —Sealed January 15, 1820. (*For copy of Specification, see Repertory, Vol.* 38, *second series, p.* 1.)

JOHN OLDHAM, of South Cumberland Street, Dublin, Esquire, for certain further improvements on his former Patent, bearing date 10th day of October 1817, for an improvement or improvements in the mode of propelling ships and vessels on seas, rivers, and canals, by the agency of steam.—Sealed January 15, 1820.

JOSEPH MAIN, of Bagnio Court, Newgate Street, London, Gentlemen, for a method of preparing and spinning wool, cotton, silk, flax, fur, and all other fibrous substances.—Sealed January 15, 1820.—(*For copy of specification, see Repertory, Vol.* 42, *second series, p.* 68.)

JAMES THOM, of Wells Street, St Mary-le-bone, Middlesex, Piano-forte Maker, and WILLIAM ALLEN, of Castle Street, in the same parish, Piano-forte Maker; for an improvement in piano-fortes.—Sealed January 15, 1820.

MARC ISAMBARD BRUNEL, of Chelsea, Middlesex, Engineer; for certain improvements in making stereotype plates.—Sealed January 25, 1820.

PHILLIPS LONDON, the younger, of Cannon Street, London, Practical Chemist; for a method of destroying or decomposing the offensive vapour arising from animal or vegetable matter when heated.—Sealed January 25, 1820.—(*For copy of Specification, see Repertory, Vol.* 42, *second series, p.* 132.)

DANIEL TREADWELL, late of America, but now of Newman's Court, Cornhill, London, Engineer; for certain improvements in the construction of printing-presses.—Sealed January 25, 1820.

JOHN MOODY, of Margate, Kent, Gentleman; for an ink-stand, containing carbonaceous and extractive matter in a dry state, which, with the addition of water only, will supply ink.—Sealed January 25, 1820.

LIST OF NEW PATENTS.

Henry Hardingham Leggett, of Fulham, in the County of Middlesex, Gentleman, for certain improvements in the art of printing in colours.—Sealed November 23, 1833.—(*Six months.*)

Thomas Parsons, of Newport, in the County of Salop, Gentleman, for certain improvements in locks for fastenings.—Sealed December 3, 1833.—(*Six months.*)

John Hall, of Breezes Hill, Ratcliffe Highway, in the County of Middlesex, Sugar Refiner, for certain improvements in filters for sugar and other liquids.—Sealed December 6, 1833.—(*Six months.*)

Joshua Wordsworth, of Leeds, in the County of York, Machine Maker, for certain improvements in machinery or apparatus for heckling flax, hemp, and other fibrous substances requiring such process.—Sealed December 6, 1833.—(*Six months.*)

Ernst Wolff, late of Leeds, in the County of York, Merchant, but now of Stamford Hill, in the County of Middlesex, Gentleman, for a mode or modes of supplying stoves with heated air, without bellows or blow pipe. Communicated by a foreigner residing abroad.—Sealed December 7, 1833.—(*Six months.*)

John Wisker, of Vauxhall, in the County of Surrey, Potter, for certain improvements in machinery or apparatus for grinding covers or stoppers for jars, bottles, and other vessels, made of china, stone, or other earthenware. —Sealed December 11, 1833.—(*Six months.*)

John Baptiste Constantine Forassa, of Newington Causeway, in the County of Surrey, Gentleman, Paul Isaac Muston, of Austin Friars, in the City of London, Merchant, and Henry Walker Wood, of the same place, Merchant, for certain improvements in making or producing the pigment commonly known by the name of

white lead, or carbonate of lead.—Sealed December 11, 1833.—(*Six months.*)

Thomas Affleck, of the Town of Dumfries, in the County of Dumfries, Scotland, Merchant, for certain improvements in the means and machinery for deepening and excavating the beds of rivers, removing sand-banks, bars, and other obstructions to navigation.—Sealed December 11, 1833.—(*Six months.*)

Riley Carr, of Sheffield, in the County of York, Manufacturer, for certain improvements in machinery for cutting, cropping, and dressing woollen and cotton cloths. —Sealed December 11, 1833.—(*Six months.*)

Robert Stephenson the Younger, of Saint Mary's Cottage, Devonshire Hill, Hampstead, in the County of Middlesex, Civil Engineer, for an improvement in the mode of supporting the iron rails for edge railways.—Sealed December 11, 1833.—(*Six months.*)

Samuel Willman Wright, of the London Road, in the Parish of St. George's, Southwark, in the County of Surrey, for a certain improvement or certain improvements in the combination and arrangement of machinery or apparatus, whereby certain well-known agents may be employed in producing power, and in the mode of effecting the same, applicable to various useful purposes.—Sealed December 16, 1833.—(*Six months.*)

Thomas Sunderland, of Blackheath, in the County of Kent, Esquire, for certain improvements in propelling vessels.—Sealed December 19, 1833.—(*Six months.*)

Charles Chubb, of Saint Paul's Church Yard, in the City of London, Patent Detector Lock Manufacturer, and Ebenezer Hunter, of Wolverhampton, in the County of Stafford, Locksmith, for certain improvements in locks used for fastening and security.—Sealed December 20, 1833.—(*Six months.*)

David Rowland, of No. 68, Crawford Street, in the Parish of Saint Marylebone, in the County of Middlesex, Mechanic, for an improvement in the manufacture of sextants, quadrants, circles, and other instruments used

in taking observations and surveys.—Sealed December 20, 1833.—(*Two months.*)

Louis Quaintin, of Subloinero Hotel, Leicester Square, in the County of Middlesex, Carriage Builder, for certain improvements in the construction of carriages.—Sealed December 20, 1833.—(*Six months.*)

James Hamilton, of Threadneedle Street, in the City of London, Civil Engineer, for certain improvements in machinery for sawing, boring, and manufacturing wood applicable to various purposes.—Sealed Dec. 20, 1833.—(*Six months.*)

Thomas, Earl of Dundonald, of Regent's Park, in the County of Middlesex, for certain improvements in the construction and operation of rotary engines and apparatus connected therewith.—Sealed December 20, 1833.—(*Six months.*)

Josiah Gilbert Pierson, of New York, in the United States of North America, but now residing in Ludgate Hill, in the City of London, for certain improvements in the construction of bolts and latches, to be attached to doors and other situations where a secure fastening may be required.—Sealed December 20, 1833.—(*Six months.*)

John Paul Newmann, of Cornhill, in the City of London, Merchant, for certain improvements in making or producing leather from hides and other skins. Communicated by a foreigner residing abroad.—Sealed December 21, 1833.—(*Six months.*)

John Howard Kyan, of Upper Baker Street, in the County of Middlesex, Esquire, for a new combination of machinery to be applied to the present purposes of steam navigation, in aid of and in substitution for the motive power hitherto and at present obtained and afforded by the application of steam.—Sealed December 21, 1833.—(*Six months.*)

George Dickenson, of Buckland, near Dover, in the County of Kent, Paper Maker, for an improvement or improvements applicable to making of paper.—Sealed December 28, 1833.—(*Six months.*)

THE

REPERTORY

OF

PATENT INVENTIONS.

No. II. NEW SERIES.—FEBRUARY, 1834.

Specification of the Patent granted to Richard Francis Stiles Blake, *of the Royal Dock-Yard, Portsmouth, Shipwright, for an Improvement in Fids for the Upper Masts, Running Bowsprits, and Jibbooms of Ships and other Vessels.*—Sealed August 14, 1833.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Richard Francis Stiles Blake, do hereby declare the nature of my said invention to consist in allowing one end of the fid to rest on a moveable bearing plate, and suspending the fid in the fid-hole or fid-mortice, by means of a pin or pivot on which it turns, or rather balances in such manner, that when the fid is not in action, one end drops and the other rises, until both ends come within the fid-hole. And in further compliance with the said proviso, I, the said Richard Francis Stiles Blake, do hereby describe the manner in which my said invention is to be performed, by the following statement thereof,

reference being had to the drawing annexed, and to the figures and letters marked thereon (that is to say):—

Description of the Drawing.

Fig. 1, represents my said invention in section, as applied to a top-mast. A, A, is the heel of the top-mast: the part shaded black is the fid-hole or fid-mortice. M, E, is the fid. H, is a pin or pivot which supports it in the fid-hole, and on which it turns. K, is the fid-plate. N, is a fixed bearing plate on the trestle-tree, to receive the end M, of the fid; and F, is a moveable bearing plate on the opposite trestle-tree, to receive the end E, of the fid. It will be observed, that the moveable plate F, is an inclined plane, and the end E, of the fid, is cut to a corresponding inclination; the object of which is to facilitate the removal of the moveable plate F, when it is required to strike the top-mast. The compasses P, are placed to shew the mode of obtaining the arc R. The distance from the centre of the pin H, to the underside of the fid-plate K, in a perpendicular direction, must be ascertained, and will be the radius for the arc R. Now it is evident, that the pin or pivot H, being to one side of the line of centre J, if the top-mast be raised so as to lift the ends of the fid sufficiently above the bearing plates N, and F, the end E, of the fid being the farthest from the centre, will drop, and the other end M, will rise, till the whole fid is brought within the fid-hole, and assumes the position shewn by the dotted lines in this figure, and the top-mast may be raised or lowered at pleasure, without impediment. But whereas it is very important that sailors should possess the power of lowering the top-mast on certain occasions without first slacking the rigging for the purpose of raising the fid from its bearings, and a contrivance for this purpose is shewn at G, in fig. 2, which figure represents a front elevation of a mast-head and heel, or lower part of a top-mast; and it may be as well here to state, that similar letters of reference are used to

denote similar parts in all the figures, wherefore I shall only deem it necessary particularly to describe the part marked G, in this figure, which is, in fact, simply a groove cut in the inner side of the trestle-tree, sufficient to allow of the end E, of the fid to fall into the position shewn by the dotted lines as soon as the bearing plate F, is removed without the necessity of raising the top-mast in the slightest degree.

I will now proceed to describe the way in which I propose to remove the moveable bearing plate F, when it is required to strike the top-mast without slacking the rigging: this may be done in small vessels, as shewn at fig. 3; but in large vessels it may, perhaps, require a stronger power, as shewn at fig. 4.

Fig. 3, is a plan of a part of the trestle-trees and a fore cross-tree. A, is the heel of the top-mast shewn in section; and B, the head of the lower mast shewn in the same way. D, D, are the trestle-trees; and F, is the moveable bearing-plate lying over the groove G, and turning on a pivot at its after end, while at its forward end is an eye-bolt to which a small rope may be attached, and in small craft a strong pull on that rope will always be sufficient to remove the bearing plate to the position shewn by the dotted lines at L, which will allow the fid to disengage itself from the opposite bearing plate, as before explained. S, is a safety-stop to prevent the moveable bearing-plate from accidentally slipping out of its place, and must, of course, be removed before the rope is pulled upon.

Fig. 4, is a mode of removing the bearing plate in large vessels, where it may be expected there will be a great weight on the plate, and, consequently, great friction to overcome. T, is a small lever turning on a pivot at V, with a crutch or fork at W, to hold the end of the bearing plate, and kept in its position by a pin at X; when this pin is removed, and a purchase applied to the end Y, of

the lever, it will force the bearing plate from under the fid, let the weight upon it be what it may.

Fig. 5, shews another form of fid upon the same principle with the support-pin in the centre; and it is only necessary to state, that if this form be adopted, the end E, of the fid should be made heavier than the other end, to make the fid self-acting in the fid-mortice.

Figs. 6 and 7, shew the application of my invention to a running bowsprit, which may either be fitted with a separate fid in each reef-mortice, or have a moveable fid applicable to all.

Now whereas I claim as my invention the following improvement, that is to say, having the fid attached to the spar with which it is to be used or held within the fid-hole, and turning or balancing on a centre or pivot, and resting at one end on a moveable bearing plate lying over a groove cut in the trestle-tree, in such manner, that by taking away the support from, and lowering one end of the fid, both ends are brought completely within the fid-hole, and no impediment offered to the raising, lowering, or sliding in or out, as the case may be, of the spar, as is hereinbefore described. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called England; his said dominion of Wales, or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same; and that I do verily believe this my said specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Mitchell's Patent.

Fig. 1.

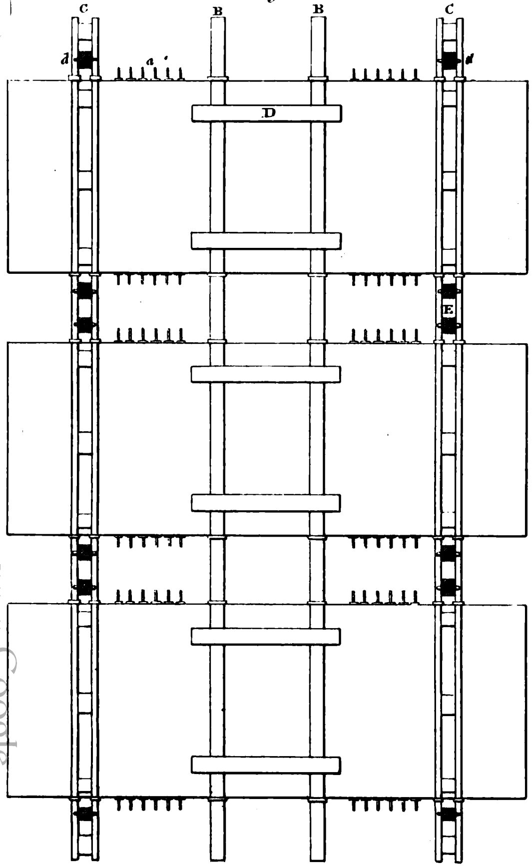


Fig. 2.

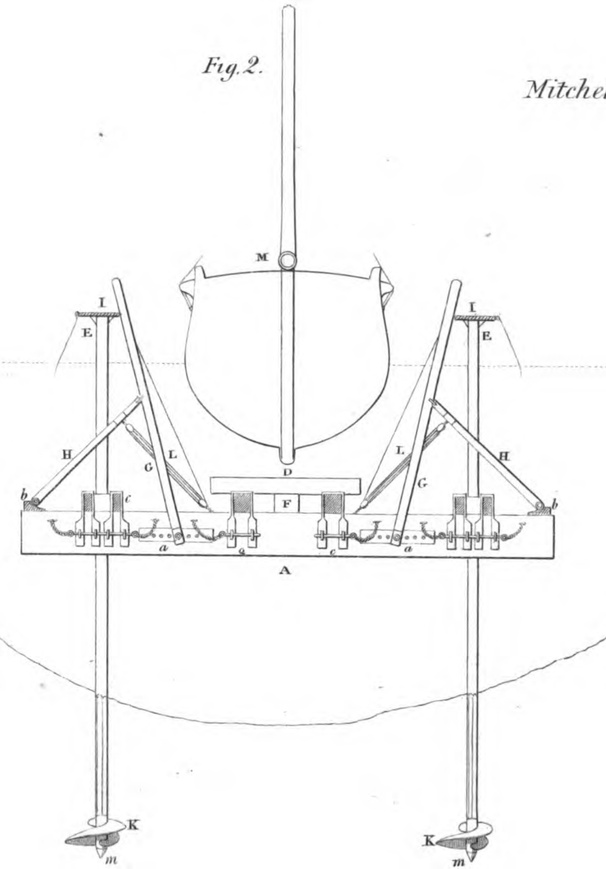
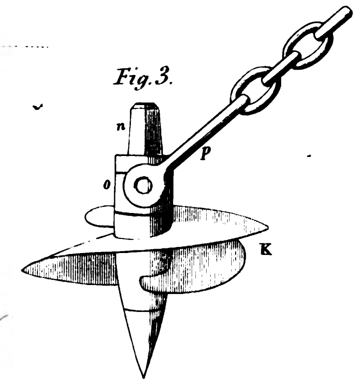


Fig. 3.



Specification of the Patent granted to ALEXANDER MITCHELL, *of Brickfield, in the parish of Ballymacarrett, county of Down, Ireland, Civil Engineer, for a Dock of improved construction, to facilitate the repairing, building, or retaining of Ships and other floating bodies.*—Sealed July 4, 1833.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Alexander Mitchell, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are described and ascertained in manner following:—

My invention of a dock of improved construction to facilitate the repairing, building, or retaining of ships and other floating bodies, consists in the application of several close water-tight boxes or cases, or rafts of timber combined in such a way as to form a flooring for the support, or carrying or bearing upwards of the vessel, or other body, to be repaired, by the buoyancy or power of floatation of the said boxes or rafts in water; and in my mode of applying such boxes to the specified purpose, I propose to employ commonly, for retaining the pontoons in their proper places, piles, posts, or beams, or metal pins, furnished at their lower ends with a spiral flange, or worm of metal, for the purposes of facilitating their introduction into or extraction from the ground, and of giving them a firmer hold therein; which piles, or mooring chains, with their pins so armed, are also applicable to other purposes, for which other uses I claim them as parts of my present invention under these letters-patent. I employ these boxes, commonly known by the names of pontoons or caissons, or the rafts of timber in some cases, of such magnitude and in such number as shall be adequate to support out of the water, by their combined

buoyancy, the largest vessel of the class the dock is designed to take in; and I so affix the pontoons to each other, and station them in a tide-water not exposed to swell or strong current, that they may rise and fall together with the ebb and flux of the tide; or that they may be retained at pleasure at their low-water level, whilst the water of the flowing tide rises above them.

For a floating dock to hold vessels in admeasurement below or not much exceeding sixty-four feet keel and eighteen feet beam, I propose to employ three caissons, of the dimensions of about forty feet in length, fourteen and a half feet in width, and three feet in depth outside measure. These caissons must be sufficiently strongly framed and timbered to bear the strains and pressure to which they will have to be exposed, and seamed so securely as to prevent, as much as possible, leakage under the great pressure of their load. For caissons of the dimensions above stated I recommend that the floor timbers should be a keelson of at least twelve inches square, with two other long joists or timbers about eight inches square, lying longitudinally midway betwixt the keelson and side pieces, and that the side and end pieces of the floor frame should be about fourteen inches wide by eleven inches deep; these floor timbers should be natched together, and laid flush on their lower sides. The corner pieces may be short pieces of fourteen inches square, natched into the angles of the floor-frame and set upright, and the side and end timbers about eight inches square natched and set upright in like manner upon the exterior timbers of the flooring; these may be set at about eighteen inches space and timber. On the inner faces of the upright timbers clouts, running the length of the sides and ends, should be affixed, to take the ends of the deck-beams and of the deck-planks, the upper surface of the side cleats being below the top of the timber about four inches, that of the end cleats on the level of the top of the beams. The deck beams should be about eight inches

square, and distant from each other three feet, beam and space; they should be dove-tail natched at the ends into the cleats. The cleats may be at first spiked to the side timbers; but when the side planks are put on the same trenails which hold the planks, may pass through the cleats and hold them too. The cleats may be about eighteen inches deep, six inches on the upper face, and three inches on the lower. The floor planks run transversely about twelve inches broad by three inches thick, and are trenailed to the flooring timbers. The side and end planks should be (to have as few seams as possible) eighteen inches broad, five inches thick, and trenailed to the upright timbers. The deck planks run lengthways of the vessel, about six inches broad by two and a half inches thick, and nailed to the beams. In laying the side and end planks, it should be observed that the outer ends of the upper side planks should come flush with the end of the caisson, and the outer ends of the lower end planks flush with the sides of the caisson, that the downward pressure may not tend to open the seams.

To give greater stiffness to the vessel to resist pressure from without, braces may be set in the way of principals from notches near the ends of the keelson up to the middle beam, through which a king-bolt may be passed, to be screwed down by a nut to a stirrup-iron, bolted across the middle of the keelson. Shores or props may also be fixed betwixt the beams and the flooring timbers in their lines of intersection.

To make a platform of the caissons, or floor of the floating dock, they must be placed in the water parallel to each other, about five or six feet apart, and connected by strong beams laid across their decks, and running the whole length of the proposed flooring. Two of these beams, about sixty feet in length, or rather more, and fourteen inches square, are to be laid across the caissons, at equal distance from the middle transverse line, and about eight feet asunder. These we will call the side-strokes, and

across them transoms are to be laid on which the keel of the ship or vessel is to rest. Two other beams of similar scantling are to be slit, and the flitches, blocked apart to the distance of thirteen or fourteen inches, are to be bolted together in pairs, and placed parallel to the side-strokes, the openings betwixt the flitches being vertical, within about eight feet of each end of the caissons. These double or slit timbers we may distinguish by the name of holding-beams. All the long beams lying across the decks of the caissons must be made fast to each caisson in some suitable way, so as to lock together the whole floating platform: the mode exhibited in the drawings by straps, staples, and pins is efficient and convenient, as allowing the caissons to be shifted farther from or nearer to each other than at pleasure. The spaces betwixt the flitches of the holding beams are to admit the passage of the piles which retain the dock in its situation in the water, and must be sufficiently wide to allow of the easy rise and fall of the dock with the tide by their guidance.

To retain the dock in its situation, but to allow it when necessary to rise and fall with the tide, I commonly employ piles set upright in such a way as to prevent the current from displacing the floating flooring, and at the same time to serve as guides to it in its motions of ascent and descent with the variable level of the water. The mode of arranging the piles, as shewn in the drawing, fig. 1, where they pass through the spaces betwixt the flitches of the holding beams, is generally perhaps the most convenient for the business of a repairing dock, but circumstances may occur under which this mode of placing them may be departed from with advantage. The piles so to be employed for retaining the floating dock in its situation in the tide water may be of the ordinary kind, namely, beams or sticks of timber, pointed or cut wedge-shaped at their lower extremities, and shod so as to admit of their being driven firmly into the ground by the ram in the ordinary way; and I should consider my floating

dock fitted with such piles to be completely effective for all its designed purposes; but in the place of such ordinary piles I prefer to use, in the construction of my aforesaid dock, piles otherwise fashioned, and fitted with an apparatus by means of which they can be inserted into the ground without the aid of a ram or pile-driver, can be easily removed therefrom at pleasure, and by means of the same when in the ground they have greater power of resisting upward or downward pressure. The apparatus which I so employ to give the piles these properties is a broad and short worm, or screw, of cast iron, fitted on the lower extremity of the stick. This worm is a broad flange, coiling helically about one and a half turns round a hollow socket, and cast together of one piece: the worm-plate thinning off gradually from where it springs from the socket to its outer margin. The circumferential line of the worm describes a double volute in reference to the axis of the socket, curving spirally inwards towards the centre, at both its terminations. Such a form facilitates its cutting through the ground, and with the same view the edge is made more acute on those portions of the curve which run in towards the socket. The socket is a short tube, either cylindrical, conical, or prismatic, which receives the lower end of the pile, shouldered down, and shaped to enter and fill its cavity, and having its extremity passing a little through the socket, shod with a conical iron ferule to enable the instrument more readily to penetrate the ground. Two or more thorough-pins driven through the timber and holes in the socket, and rivetted at the ends, secure the worm to the pile. The piles so armed can be readily inserted into penetrable ground by setting them vertically in their assigned places, their points downwards, and turning them round by means of cross levers. In the same way, by a reverse rotation, they can be readily withdrawn when occasion requires. In some cases, where it may be thought expedient for merely temporary purposes to dispense with the insertion

of piles to retain the dock; or, where the force of the current may make it advisable to use means to lessen the lateral stress upon the piles when used, I employ the same kind of worm as above described, fitted with a central pin of iron, and a shackle on a loose collar, to obtain through a strong chain a secure and convenient mooring. The central iron pin for this form of the apparatus is pointed below and fits into the tapering cavity of the socket, the pointed end passing through; and above the upper margin of the socket it stands up so far as to admit on the upper part of the shaft of the pin, which is cylindrical, a strong collar of iron, which turns easily upon it, betwixt the margin of the socket and a projecting shoulder on the pin. The central pin and the socket are fixed to each other by strong thorough-pins. The head of the central pin above the shoulder is made pyramidal or prismatic, to receive the key which is used to turn it into or out of the ground. The loose collar has two projecting journals forged on it to receive the eyes of a shackle by which a mooring chain is connected with it. This loose collar allowing the pin to turn within it, whilst the worm is being screwed into or out of the ground by means of the key, prevents any impediment to the operation from the chain. The key for acting on this screw-mooring is a socket of iron fitting upon the head of the central pin, and having a shaft of suitable length for the proposed depth of water and of insertion into the ground. I find it convenient to make the shaft for the key of wrought iron tube, in about ten-feet lengths, four to six inches diameter, and one-quarter or three-eighths thick. These tubes, filled with wood inserted wedge-wise, are solid and light, and resist torsion with sufficient power. The lengths of shafting may be conveniently jointed together by a short pin or piece of smaller tube fitting within the outer tube at one end, and projecting eight or ten inches out of it, so as to receive upon it the end of the next piece of shafting: fixed and moveable steel pins passed

through the outer and inner tubes will hold them together, but to connect the lengths more securely to resist torsion it will be advisable to scarf or notch the ends of the outer tube so as to fit like teeth into each other. To obtain a hold of the shaft for the purpose of turning in or out the mooring screw, it may be necessary to weld or pin upon the shaft at convenient distances for allowing the cross levers to be worked, angular bosses on which a plate key will fit, and can be passed over from one to another.

The piles for a floating dock should be sticks of timber of twelve or fourteen inches square, and of sufficient length to stand five or six feet above high-water mark at spring-tides, when inserted from twelve to twenty feet into the ground. All the tide-range of the pile should be left square; the lower part may have the angles dressed off and be gradually rounded as far as it is to enter the ground, and tapered and shouldered to fit into the socket of the worm. To stiffen this portion of the pile against twisting, strong hoop iron may be coiled and nailed upon it spirally in a direction contrary to that of the thread of the worm. On the two opposite flat faces of the piles which are to stand parallel with the long timbers of the dock, plates of iron of from four to five feet in length, about six inches broad, and three quarters of an inch thick, are laid in flush and screwed or bolted on, the lower ends of the plates being about low-water mark. These plates are perforated correspondently with holes of from two and a half to three inches diameter, and about three inches apart, and the timber is to be bored coincidently with the plate holes to allow a wrought iron pin filling the bore to pass through. As the dock rises and falls with the tide, the flitches of the holding beams will move along the faces of the perforated plates; but when it is necessary to hold down the flooring of the dock to prepare it to receive a vessel, the iron pins stretching across the flitches of the holding beams must be introduced into the proper holes at low-water, and the tide will then flow

over the caissons and flooring timbers. To stiffen the piles as they stand in their places by tying them one to another, and at the same time to obtain a convenient gang-way, a platform of planks is fixed on the heads of the piles running the whole length of the dock on each side.

To keep the vessel in its upright position until the water leaves the floor of the dock, there must be bearing bars, which can be brought up and held securely against the vessel's sides by shores. These may be efficiently arranged in the following way. On the sides of the caissons there must be bolted or screwed strong perforated iron plates, corresponding in length and situation with the spaces betwixt the side-strokes and the holding-beams; the plates may be about seven feet long, five inches broad, and half an inch thick, and perforated with a row of holes of an inch and a quarter diameter and one foot apart. The plates must be so set that the holes come opposite to near the lower edge of the cleats on the side timbers, in order that the pins which are to pass into the plate holes may go through the planks and cleats to get a stiffer hold, and being drawn inwards by nuts on the tails of the pins give some additional strength to the sides. The pins should have conical shoulders to drop into counter-sunk holes in the plates, and the tails may taper inwards where they pass through the planks and cleats, that as they are drawn up by the nuts they may be made to fill completely the holes in the timber. Projecting outwards beyond the plate, the pins should be cylindrical, and have six or seven inches of length. Pieces of oak scantling, about twenty feet long, nine inches broad, and five inches thick, having an iron hoop near their lower ends drilled to admit the projecting pins, are set on the pins one for each side of the vessel on both sides of each caisson, so that they are carried on the pins and can turn upon them as centres through a certain range. They may be secured on the pins by cotters and washers, and

readily shifted from one pin to another, according to the different breadths of vessels to be supported. The upper ends of these supporting pieces or bearing bars, when thrown back preparatory to the admission of a vessel into the dock, rest against the edge of the gangway on the pile-heads. To bring the supporting pieces up against the sides of the vessel and hold them there, shores are placed behind them having their abutments in cast-iron shoes bolted upon the decks of the caissons, their upper ends pressing against the back edges of the supporting pieces, and being prevented from slipping sideways by a clip of iron on each side. These shores may be brought forward and made to press the supporting pieces up against the ship's sides, and to hold them there by a tackle strained betwixt the upper end of the shore and a ring bolted into the deck of the caisson, as shewn in the drawing.

To prepare the dock for receiving a vessel, it will be necessary at low water to pin down the flooring by passing the strong pins through the holes in the piles nearest above the upper surface of the holding beams. The supporting bars are to be thrown back to rest against the gangway. The transoms lying across the side-strokes at about six feet apart, and blocked under their middle, are to be secured in their places by dogs. The rising tide will then flow over the flooring of the dock. At high water the vessel to be docked must be brought into such a situation, that its keel, as the vessel drops with the ebbing tide, will take the middle of the transoms. This may be readily accomplished by making the bearing-bars to press against her sides, by pulling at the tackle-falls from the gangway. When she has settled down into her place, and rests upon the transoms, the docks being left by the water, the vessel must be made safe in her upright position by shoring, from the decks of the caissons to her sides. At low water the pins may be struck out of the piles, and with the returning tide the vessel will be borne

up by the buoyant flooring. When the vessel is to be removed from the dock, the flooring must be again pinned down at its low water level, and the rising tide will then float off the ship.

In the drawings which accompany this description, and form part of my specification, the same parts are in the several figures distinguished and referred to by the same letters or marks; and the parts connected in construction are drawn to scales marked on the sheets. In the actual structure of such docks, the dimensions and proportions of the whole, or of parts, may be varied according to circumstances.

Fig. 1, horizontal view of the dock.

Fig. 2, transverse view.

Fig. 3, transverse section of a caisson.

Fig. 4, outside face of a pile in connection with a holding beam and caisson.

Fig. 5, a mooring-worm or screw and its several parts. A, caisson. B, long beam named a side-stroke. C, long beam slit and blocked out, named a holding beam. D, transom. E, pile. F, block. G, supporting piece or bearing-bar. H, shore. I, gangway. K, worm. L, tackle. M, ship. N, cross levers to turn the piles. *a*, pins and plates on sides of caissons. *b*, shoring-shoe bolted on the deck. *c*, holding straps or stirrups. *d**, cross-pins to hold down the floor of the dock when required. *d*, keelson. *e*, floor timber. *f*, side-flooring timber. *g*, deck-beam. *h*, side timber. *i*, cleat. *k*, *l*, perforated plates on the faces of piles. *m*, shoe of ferule of the pile. *n*, pin or shaft of the mooring-screw. *o*, loose collar. *p*, shackle. *q*, key for mooring-pin. *r*, section of key-shaft. *s*, exterior of key-shaft. *t*, angular boss for key, pinned or welded on key-shaft, at convenient distances, for working the cross levers. The worms for the piles, or for the mooring-screws, may, of course, be varied in dimensions, say from two to five feet, or more or less, according to the nature of the

ground, or the degree of resistance called for by the work in which they are employed.

Now I declare my invention to consist, in the first place, in the formation of a graving dock with a buoyant flooring, which, being held down by any suitable contrivance, at its level of low water, in a tide-way, when desired, can be subsequently liberated so as to rise and fall with the tide, and to carry upon it the ship or vessel to be repaired or built; and I claim such a dock with a floating floor to be of my invention, under the privileges of the before recited letters patent, whether the buoyancy of the floor be obtained by the means of hollow air-tight vessels, such as the caissons herein described, or by the means of any other form of hollow air-tight vessels suitable for the purpose; or whether the buoyancy of the floor may be derived simply from the specific gravity of the materials employed in its construction, being less than that of the supporting medium; and I claim as of my present invention, such a dock with a buoyant flooring, whether the flooring be retained in its situation and guided in its rise and fall by piles, as herein shewn, or otherwise arranged, or whether the movements and position of such flooring be controlled and regulated by the means of mooring chains or cordage however arranged and made fast. And I declare my invention under the present letters patent, further to consist, in the application to the lower end of a wooden pile, or to a metal pin or shaft, of a broad metal screw or worm, for the purpose of enabling such a pile or pin to be inserted into, or extracted from the ground, by causing it to turn upon its axis by means of cross-levers, when it is placed with its point directed upon penetrable ground; and I claim under the privileges of the before-mentioned letters patent, piles, pins, or shafts, so armed with broad metal worms or screws, whether the same be employed in the construction of a dock, as herein described, or for piling ground for the support of buildings or embankments, or to obtain a

secure hold of the ground for the purposes of mooring or holding fast ships and other floating or stationary bodies. And I further declare, that I do not claim any exclusive right to the use of such other things mentioned or described in this specification, which are well known and of common use, except in so far as they may be applied to the especial purposes of my invention now specified.— In witness whereof, &c.

Enrolled January 4, 1834.

Specification of the Patent granted to James Brown, *of Bird-in-Bush Terrace, Salmon's Lane, late of Margaret Street, Commercial Road, in the County of Middlesex, Rigger, for certain Improvements on Capstans and Apparatus to be used therewith.* —Sealed Feb. 14, 1833.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.— *Now know ye,* that in compliance with the said proviso, I, the said James Brown, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon; (that is to say) my improvements in capstans and apparatus to be used therewith, consist of certain combinations of mechanical means for obtaining power to capstans, as will be fully described hereafter.

Description of the Drawing.

Fig. 1, represents a capstan having my improvements applied thereto.

Fig. 2, represents a plan of the capstan-head, the top or cover being removed for the purpose of exposing the

mechanical combinations for producing power to the capstan more clearly to the view.

Fig. 3, represents a capstan constructed according to my improvements, the mechanical means of obtaining power to the capstan being somewhat different to those shown in figs. 1 and 2.

Fig. 4, is a plan of fig. 3, which is also shewn uncovered, that the internal arrangement of the mechanical means contained in the capstan head may be more clearly seen and understood.

It will be desirable here to observe, that the same letters of reference serve to denote the same parts in each of the figures of the drawing. But first of the capstan represented in figures 1 and 2: *a*, is the drum or body of the capstan, which turns on the perpendicular shaft or spindle, *b*; this shaft or spindle is affixed to the deck or other situation, according to the intended use, and is so fixed as to be prevented turning. *c* is the capstan-head, which I usually construct of cast-iron, and consists of the outer frame, *c*, and the cross-braces, *d*, as will be clearly seen in the figures 1 and 2. This drum-head, *c*, *d*, is keyed and wedged to the spindle or shaft, *b*, having a square head, by the keys, *e*, *e*, and thus in the capstan-head affixed to the shaft or spindle, *b*, and is consequently stationary; the capstan-head not being in any way affixed to the drum or body, *a*, of the capstan. *f*, is a screw affixed on the shaft, *g*, there being a recess, *h*, cast at the back of the capstan-head, to receive the screw, *f*, as is clearly shewn in fig. 2. The shaft, *g*, turns in bearings on each side of the capstan-head, but the bearings on each side of the capstan are elongated to allow of the shaft, *g*, being slided along when it is desired to put the screw out of gear. *i*, *i*, are plates placed on each end of the shaft, *g*; the object of these plates is to hold the screw in gear when required, and this is effected in the following manner; in each of the plates, *i*, is formed a circular hole,

through which pass the ends of the shaft, *g*; there is also a slot, *k*, cut towards the other ends of the plate, *i*, through which a screw-bolt, *l*, passes, and is made fast to the frame, *c*, of the capstan-head, this screw-bolt having a head which projects beyond the slot, *k*, and thus holds the plate at that end. *m*, is a handle by which this plate is raised when it is desired to throw the screw out of gear. In fig. 1, the screw is represented as being in gear, consequently, when it is desired to put it out, it will only be necessary to raise the ends of the plate, *i*, by the handles, *m*; by this means the screw-bolts will be at the bottom of the slots when the plates, *i*, may be forced back sufficiently to put the screw out of gear, when the plates, *i*, may be lowered by the handles, *m*, and they will be retained in this position. It will be evident to again put the screw into gear, the plates must be again raised, and then slided forward, and brought down to the position shewn in fig. 1. The screw, *f*, takes into and drives the toothed wheel, *n*, which is affixed to the drum or body of the capstan. The two ends of the shaft, *g*, are squared for the purpose of receiving winch handles, as is shewn by dotted lines. By this application of a screw together with a toothed wheel within a fixed and stationary head of a capstan, a very powerful though slow action can be obtained to the drum or body of the capstan, and thus enable a few hands to raise very heavy weights, as will be evident to all who are acquainted with the nature of applying a screw to a tooth-wheel. When quicker revolution is desired to the drum or body of the capstan, it will be necessary to throw the screw out of gear, and bring the pinions, *o*, *o*, into work; these pinions are affixed on spindles, *p*, *p*, which have their bearings in recesses cut or formed in the centre part of the capstan head, as is shewn in the drawing, in figs. I and 2. The other end of the spindles, *p*, *p*, pass through slits formed in the framing, *c*, of the capstan-head, and pass through the plates, *q*,

these plates being affixed to the frame, *c*, by means of two screw-bolts, *r*, *r*, one of which being withdrawn permits the plate, *q*, turning on the other, and thus raising the teeth of the pinions out of gear when desired. *s*, is a horizontal toothed wheel affixed on the top of the drum or body of the capstan, as is clearly shewn in fig. 2; into this wheel, *s*, the pinions work, the shafts or spindles, *p*, being squared to admit of winch handles, as is shewn by dotted lines; by this arrangement, a quick action may be obtained to the drum or body of the capstan, and the power may be proportioned to the work to be done.

Figs. 3 and 4, represent a capstan having four pinions, similar to those described in figs. 1 and 2, working into a similar horizontal toothed wheel, and as the various parts are indicated by the same letters of reference as those already described, it will not be necessary to go again into that description, as the construction of this capstan will be evident, it differing only in not having a screw, but in place thereof there are two additional pinions. Having now described the nature of my invention and the manner of performing the same, I would have it understood that I lay no claim to the various parts separately of which the same is composed, they being separately well known and in use. But what I claim as my invention is, first, the application of the screw *f* to a fixed and stationary capstan-head for the purpose of driving the drum or body of the capstan; secondly, in applying one or more pinions to a fixed and stationary capstan-head, for the purpose of driving the drum or body of the capstan as above described, whereby great facility is obtained in the working of capstans, and at the same time great power may be obtained to such capstans.—In witness, &c.

Enrolled August 13, 1833.

Specification of the Patent granted to LOUIS SCHWABE, *of Manchester, Manufacturer, for certain Processes and Apparatus for Preparing, Beaming, Printing, and Weaving Yarns of Cotton, Linen, Silk, Woollen, and other Fibrous Substances, so that any Design, Device, or Figure printed on such Yarn may be preserved when such Yarn is woven into Cloth or other Fabric.* —Sealed January 22, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c. *Now know ye,* that in compliance with the said proviso, I, the said Louis Schwabe, do hereby declare that the nature of my invention, and the manner in which the same is to be performed and carried into effect is described and clearly shewn by the drawings hereto annexed, and the following description thereof, the same letters and figures marked thereon, indicating the same parts throughout. Before I commence the description of my various apparatus by which I effect the printing of yarn so as to preserve the figure or design after such yarn is woven into cloth or other fabric, I shall state a few particulars to be attended to in the selection and preparation of yarn to be used for this purpose. Although the effect which I am about to describe may be produced with yarn of any description ordinarily used as warp, yet that which I recommend, when cotton, linen, or worsted is used, is such as has been singed or gased so as to divest it of its loose fibres. This yarn should be made into hanks, and bleached or submitted to any of the ordinary preparations practised by printers previous to block printing, which preparations must altogether depend on the style of pattern which it is intended to print thereon. The yarn is now formed into a warp, and afterwards beamed in the usual manner, care being taken to have the beam particularly true. At this period of the process it is essential to pick

Fig. 1. Scale 1 Inch to the Foot.

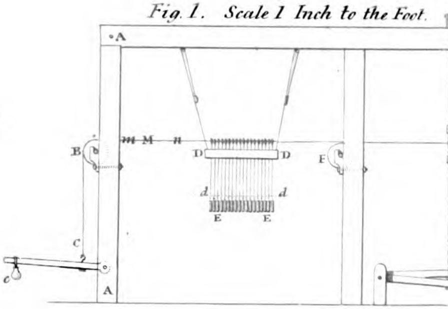


Fig. 2.
Scale 1 Inch to the Foot.

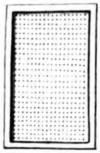


Fig. 3.

Fig. 6.
Scale 4 Inch to the Foot.

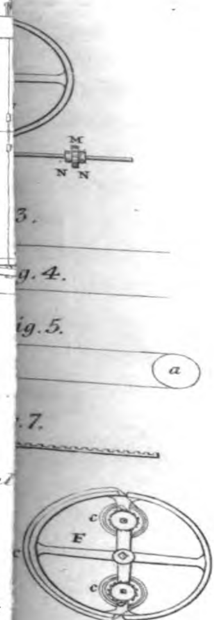


Fig. 9.

Fig. 5.

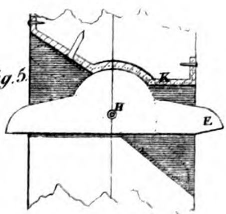
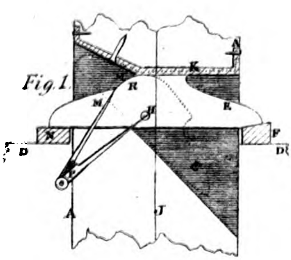


Fig. 1.



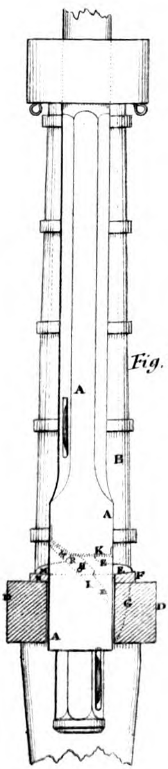


Fig. 2.

Fig. 4.

Fig. 3.

the warp carefully, and clean it in the same manner as weavers do previous to weaving cloth.

The warp being now placed on the beam, my "certain processes and apparatus" will be more clearly understood by reference to the annexed drawing, which I shall now proceed to describe along with the mode of operation by which the warp is rebeamed, printed, and wove, so that any design, or figure printed thereon is preserved when such yarn is woven into cloth.

Description of the Drawing.

Fig. 1, sheet 1, represents an elevation or side view of a machine for rebeaming the warp from the first beam on which it has been placed in the ordinary manner. In this figure A A, A A, represents the framing, and B the first beam whereon the warp is placed. This is supported on its centre and held stationary by means of a break or drag shewn at C. This arrangement of a break is too well known to require any particular description, and is regulated by the position of the weight *c* on the lever from which it is suspended. D, D, represents a board pierced full of holes, better seen in a plan of it at fig. 2. This board is suspended by means of strings from each corner, which are attached to the framing above, and so arranged as to enable the operator to place it in the position shewn at D, D, fig. 1, or lower it to the dotted line, *d*, *d*. It is called a "cumber-board," and is here for the purpose of supporting and arranging small metallic pieces, called "mails," one of which is represented at its full size at fig. 3. These mails are arranged on the upper side of the "cumber-board" one to every end of the warp and at a distance from each other, which agrees with the count or fineness of the reed to be used in the weaving about to be performed. In referring to fig. 3, it will be seen that there are two holes in the mail there represented, to the lower of which is attached a small string and leaden weight, E, fig. 1, commonly called a "lingo," so that, when put

in its place, as seen at D, D, fig. 1, the mail, being too large to pass through the hole in the cumber-board, rests on its upper surface, and is held stationary by means of the string and lingo weight, E. Through the upper hole of every one of these mails an end of the warp is passed, which proceeds forwards over the cylinder F, as seen in fig. 1, through the healds G, and the reed of the lathe H, on to the beam I, whereon it is rebeamed.

In the first operation of a machine of this construction, it will necessarily require to be gaited, or put in order by passing the ends of the warp through the respective mails and other parts of the apparatus; but supposing it to have been in action, and a warp finished rebeaming from the beam B to the beam I, the mode of proceeding would be as follows. The first warp being placed in the position represented at B, it is twisted or joined to the thrum of the last warp at the point M, in the ordinary manner the ends of the respective warps being preserved by means of leashes, as shewn at *m* and *n*. As soon as this twisting or joining of the old and new warp is effected, the beam I is revolved in the direction of the bent arrow on its periphery, and the warp drawn forward until the twisting arrives in the front of the reed H, where a piece of cloth is woven of from three to four inches, having a rod or straight piece of wood woven into it. The thrum or end of the old warp is now removed, and the remainder, which contains the rod on the new warp, is attached to an empty beam I, by means of the rod, which fits into a slot or groove in the beam I. At this period the cumber-board is lowered to the position *d*, *d*, and the mails and lingoes allowed to hang on the warp, thus producing an equal tension on every end of the warp during the rebeaming process.

It will be remembered that this machine is for the purpose of rebeaming preparatory to printing, and that the use of harness or weaving apparatus is, firstly, to weave a piece of cloth as before described, by which the rod is

secured in the warp and thereby attached to beam I; secondly, to strike a leash in front of the reed when the warp is near its termination on the beam B; and, thirdly, to weave a second piece of cloth for the purpose of securing the leash, and also for the fastening the ends of the thrum which remain in the machine for the succeeding process. In operating with this machine attention must be paid that none of the mails at any time rest on the cumber-board when in the position *d*, *d*, which would necessarily destroy their action of keeping the ends of the warp at an equal tension. I also recommend pasteboard to be placed occasionally on the beam I, during the process of filling, to keep the surface more regular. The position of the weight C, must also be attended to, as it is obvious that the drag of the beam B, must increase as its circumference decreases; but these and other minor points must be acquired by practice, and are well known to parties engaged in fancy weaving.

Fig. 4 represents an elevation or side view of another machine for the purpose of transferring the warp which has been rebeamed on to the beam I, in the last-described machine to another beam marked O, in this figure; and at the same time printing the warp so transferred with a pattern or design, which is to be preserved in the cloth into which the warp is afterwards to be woven. In this machine the beam I, containing a warp as placed by the last machine, is seen in front of the harness or weaving part of the machine; which harness, as in the last described machine, is for the purpose of weaving small pieces of cloth at the extremity of the warp, by which means the ends are kept even, and a rod inserted, as before described, for the purpose of attaching to the beam. The warp in this machine is carried in an horizontal direction from the beam I, through the healds and over a printing table N, N, to the beam O, which beam being forced round by a lever or otherwise, take up the warp from the beam I, which latter gives it off at a tension determined or regu-

lated by the friction of the drag P, and weight *p*, similar to the drag in the last machine. The gudgeons or supports on which the beam O, revolves, are elevated or depressed by a screw movement, shewn at Q, by means of which the operator is enabled to keep the warp horizontal in its passage over the printing table N, N, and to compensate for the rise caused by the filling of the beam O, during the process. In commencing with this machine it is required that a thrum be put in or drawn through the healds and the scale marked *t*, which is of a peculiar construction, hereafter described, to the end of which the new warp is twisted or pieced in the ordinary manner; and, supposing the machine to be regularly at work, and a full beam I, brought from the last described machine, the mode of proceeding would be as follows. The small piece of cloth on the new warp must be gradually cut away as the twisting proceeds, which is to join the new warp to the old thrum at the point S; and as soon as this is done the beam O, is put in motion till the twisting is carried in the direction of the arrow to the point T, at which point a piece of cloth of from three to four inches is woven by means of the scale *t*, which is suspended from the frame above by strings. This cloth is for the purpose of holding the ends correct and containing a rod as already described. This being done, the old thrum is removed, and the scale *t*, placed between the table and the beam O, at the point T, where it is suspended as before, the warp is attached to an empty beam O, and the printing commences. I must here remark that it is requisite that the machinery be accurately constructed, and the beams I, and O, parallel to each other, which being the case, it is obvious the whole of the warp will remain at an equal tension and present a uniform surface in its transit over the printing table N, N. The printing is performed by blocks, plates, or otherwise, precisely in the same manner as calicoes are printed, and the traverse of the yarn is only caused to take place at stated periods,

namely, when the printing of that part immediately over the table N, N, is completed. During this part of the process any irregularity which may arise by the moving the warp over the surface of the printing table is immediately rectified by moving the healds. Annexed to the printing table N, N, is placed a cylinder U, over which the warp passes towards the table, the upper surface of which is about one-sixteenth of an inch above the surface of the printing table and on a level with the beam O, which is adjusted by means of the screw Q, before described, so that the warp has a tendency to spring up from the blanket when released from the block which I consider essential to producing good work by my process. W and $\overset{1}{\mathrm{W}}$, fig. 4, represent two cylinders, both parallel with the beam O. On the cylinder W, is placed a piece of calico somewhat wider and longer than the warp at the commencement of printing. This calico is passed in the direction of the arrows under the printing table N, N, and over the guide roller Z, where it proceeds over the printing table and on to the upper cylinder $\overset{1}{\mathrm{W}}$, the cylinder $\overset{1}{\mathrm{W}}$, is moved by a strap from the beam O, which causes it to take up as much calico on to its surface as there is warp taken on to the surface of the beam O, thereby presenting a fresh surface of calico to every surface of warp which passes over the printing table N, N, and consequently keeping the blanket clean during the process of printing. There only remains now to remark that the healds which I have found to answer best, both in the process of re-beaming and printing, are those called long-eyed healds, from their offering less obstruction to the passage of the warp during the process, and that the use and construction of the scale *t*, is very essential to the performance of good work. This scale *t*, is constructed as follows:—Having determined the number or fineness of the reed to be used in the cloth about to be manufactured, I take the same reed for the purpose making the scale *t*, and form a

warp of strong yarn, of which I prefer hard silk, which must be carefully beamed and rebeamed in the manner already described. It must be then woven in the following manner, with as much weight as possible. First, one inch of cloth, then insert a perfectly straight iron rod, after which about half an inch more cloth is woven. This being done, about five inches of the warp is drawn over without being woven, and then another half inch of cloth is woven, and a second iron rod inserted, which is kept fast by weaving another inch of cloth as before. At this period the whole of the woven parts of the scales are saturated with a strong solution of gum, for the purpose of keeping the threads of the warp more firmly in their position. The appearance of the scale thus far constructed will be seen at fig. 7; but as the spring or elasticity of the rods x, x, which are kept equidistant by the side pieces Y, Y, would not keep the warp at the requisite tension, I have found it necessary to imbed the rods in hard wood frames, of which I represent a section at fig. 8, which when closed together, by means of screws or other fastenings, forms a scale as represented at fig. 9. The scale *t*, thus constructed, is suspended from the framing of the machine, and it is requisite, in the first place, to spread the warp to be printed even and regular in its passage over the printing table, which is effected by carrying each separate end of the warp through a distinct opening in the scale; in the next place, to obviate the necessity of rods in the subsequent process of weaving, when removed to the loom, which it does by enabling the weaver to find an end when broken, in the same manner as rods would do; and, lastly, as it is not affected by the chemical action of the mordant or other preparation used in printing, and any accumulation of mordant or other preparation is easily removed by a sponge or other means, as the process of printing proceeds. In using the scale, it is desirable to commence with the scale suspended at its highest point, and as the printing proceeds the operator should gradually

lower it as the scale becomes soiled by the printed warp passing through it, and as soon as the whole five inches of the scale which are left open for the passage of the warp have been passed downwards, it may be cleaned, which being done, it is again raised to *w*, its highest elevation, and the process recommenced; when the printing of the warp is finished, I recommend to let about one yard and a half be wound back on the beam I, and having raised the beam O, by means of the screws Q, to replace the scale in its first position at T, and weave ten or twelve picks of weft for the purpose of securing the warp ends. The printed warp is then again drawn forward to the beam O, a leash is taken and secured by weaving five or six inches of cloth with a rod in it, so that when the five or six inches of cloth is divided, the rod remains with the thrum healds and scale; and the printed warp on beam O, is removed to the loom wherein it is to be woven, and when removed to the loom the ten or twelve picks abovenamed are taken out as soon as the twisting is complete, and about a yard of cloth woven. It will also be remarked that the pasteboards which have been previously placed on the beam I, are in this process replaced on the beam O, as it becomes liberated from I, for the same purpose of keeping the warp more regular, and that the drying of the printed yarn is greatly accelerated by the use of a fan similar to those used by weavers for drying their warps in ordinary weaving. The printed warp upon the beam O, is now transferred to a loom which should have as short a ratch as can be allowed, and the greatest care must be taken that the cloth beam and the beam O, are accurately parallel, as well as that the surface of the warp be kept horizontal, which is effected by means of screws similar to those seen at Q, in fig. 4, and I also recommend in the weaving of printed yarns the use of clasped healds, which consists of opposite loops interlocked in each other, so that the warp passing through both loops, as shewn at fig. 6, is held firm in the healds and not allowed to move

in them during the action of weaving. The use of clasped healds, together with the scale *t*, which enables me to dispense with rods in the process of weaving, I consider essential to preserving the pattern on the warp, and as an important part of my invention. When the warp is woven into cloth, the pattern which has been printed on it must be dyed, raised, washed, or prepared, or perfected according to the ordinary processes used in printing, all which must depend on the previous preparation of the yarn and the style of work which it is intended to produce.

Having now described my certain processes and apparatus for preparing, beaming, printing, and weaving yarns of cotton, linen, silk, woollen, and other fibrous substances, so that any design, device, or figure, printed thereon may be preserved when such yarn is woven into cloth or other fabric, I declare that I do not claim as of my invention any separate or well-known parts of the apparatus or machinery hereinbefore described, but I do claim the arrangement and application of those parts as an apparatus, and the processes or manner of working the same, by which the rebeaming, printing, and weaving the warp so as to preserve the pattern, is effected. All which I believe to be new and never before practised in this kingdom.—In witness whereof, &c.

Enrolled July 16, 1831.

Specification of the Patent granted to Edward Cowper, *of Streatham, in the County of Surrey, and* Ebenezer Cowper, *of Suffolk Street, Pall Mall East, Westminster, in the County of Middlesex, Engineers, for certain Improvements in Printing Machines.*— Sealed July 19, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.— *Now know ye*, that in compliance with the said proviso,

We, the said Edward Cowper and Ebenezer Cowper, do hereby declare, that the nature of our invention, and the manner in which the same is performed and carried into effect, are particularly described and ascertained by the following description thereof, reference being had to the drawing hereunto annexed, and the figures and letters marked thereon (that is to say):—

Our invention consists of two parts. First, in the means of distributing the ink; and, secondly, in the method of attaching the printing cloth (or blanket) to the printing cylinder. The improvements are applicable to those machines in which the impression is obtained by passing the form of types under a cylinder, as in the former patent of Edward Cowper, to which a specification was duly enrolled, and is equally applicable to other printing machines on the same principle.

Description of the Drawing.

Fig. 1, is an elevation of the inking apparatus, and some part of the printing machine. At the end of the type-table A (the table on which the form of type is laid), we attach a drum or cylinder B, of wood or metal, about seven or nine inches diameter (more or less), the spindle of which is supported in a frame or in arms C, screwed to the type-table A. This drum may be called the distributing drum, from its distributing the ink, or may be called the travelling drum, from its travelling with the type-table, and, in this respect, differing entirely from all other systems of inking. The travelling drum has one, two, or more, distributing rollers D, lying upon or against its surface, and receiving their rotatory movement from the friction of the drum. The distributing rollers are supported in their places in notched bearings E, in the frame or arms C. If the drum be made to travel under the printing cylinder F, the upper surface of the drum should be a little below the level of the types, in order that it may not blacken the printing cylinder; but when the

drum does not travel under the printing cylinder, it may be level with the types.

The upper surfaces of the distributing rollers are about one inch below the surface of the drum. The spindles of the inking-rollers G, G, G, that is, the rollers which ink the types, lie in notched bearings in the frame of the machine, as in the former patent of Edward Cowper, the notches are cut deep enough to allow them to fall freely upon the travelling drum B, without touching the distributing rollers D. On the spindle of the drum is a small bevelled wheel H, which is turned by another bevelled wheel I, fixed on a long square rod or spindle K; this spindle is supported at one end by a carriage L, fastened to the frame C, and the other end of the spindle is supported by a square hole in a pinion M, through which it is made to slide freely. When there is an inking apparatus at each end of the machine, the square rod or spindle K, is continued through the pinion to the other inking apparatus to which it also gives motion by a bevelled wheel. The pinion M, has a round boss N, on each side of it, on which it turns in a carriage fixed in any convenient part of the machine, in the line of motion of the type-table; this pinion may be a bevelled pinion, or even a pulley, receiving its motion as may best suit the arrangements of the other parts of the machine. The edges of the distributing drum B, are not at right angles to its spindle, but are formed into slightly inclined planes or waves, as in fig. 2, which rub against fixed bosses or friction-rollers O, O, in the arms C, the spindle of the drum is either square, allowing the drum to slide freely upon it, or is round, and having a cranked driver P, fixed upon it, the cranked end Q, of the driver fitting loose into the arm of the drum, to allow the drum to be pushed in the direction of its length by the inclined planes or waves on its edge. The ink-trough, or as it is technically called, the ductor R, is placed at the end of the frame of the machine, and the ink is conveyed from the ductor to the

distributing drum by a vibrating roller S, vibrating in bearings on the frame C, which supports the distributing drum B. The vibrating roller runs in two light arms T, which are firmly fixed on the spindle V, on which it vibrates: a forked arm, or one of the arms T, is lengthened, and divided into a fork, to admit a stud W, fixed on the frames of the machine. The operation is as follows: As the type-table moves backward and forward, the distributing drum B, and its appurtenances, travel with it, the drum receives its rotatory motion by the bevelled wheels H, and I, and the pinion M, which turns the square spindle K, while the spindle passes freely through the pinion M; in the mean time the drum is receiving its lateral or end motion by means of its inclined edge rubbing against the friction-rollers O. When the drum arrives under the inking-rollers G, it imparts ink to them, and leaves them in a fit state to ink the type. As the drum approaches the ink-trough R, the fork of the arm T, of the vibrating roller comes in contact with the fixed stud W, which tilts the vibrating roller towards the ink-trough. The remaining motion of the type-table pushes the vibrating roller against the iron roller, or, as is called, the ductor roller X, of the ink-trough. As the type-table returns towards the printing cylinders, the fork of the arm T, again strikes against the stud W, when the vibrating roller is tilted back again to the drum with the ink it has received. There are various ways in which the invention of the travelling drum may be modified, but the above is the method we prefer. The rotatory motion may be given by a cat-gut band passing over a pulley on its spindle, the ends of the band being fixed to the frame of the machine, as in figs. 3 and 4, or the band may be endless, and go round two other pulleys, as at *a*, in fig. 5, one of these pulleys *a*, receiving its motion from any convenient part of the machine; or the motion may be given by a broad pinion running in a rack fixed on the frame of the machine, as in fig. 7. The lateral or end motion may

be given to the distributing rollers instead of the drum, by placing them in a sliding frame, as at *a*, in fig. 6, the drum being fixed on its spindle, and the edges of the drum being made to push the frame backward and forward in the direction of the spindle.

We do not claim the exclusive right of distributing the ink upon a drum or cylinder revolving in fixed bearings, but we claim as our invention the distributing the ink upon a cylinder or drum which is attached to the type-table, and travels with it. Our second improvement, viz. the method of attaching the printing cloth or blanket to the printing cylinder, consists, in forming the printing cylinder F, with two recesses *b*, *b*, fig. 1, in each of which we fix a roller *c*, of wood or metal, turning in carriages *d*, fixed to the cylinder at each end of the recess; or we make only one recess in the cylinder, and put both rollers into it, as in fig. 8, at *e*; or the rollers *c*, may be placed within the printing cylinder, as in figs. 9 and 10, allowing the cloth to run through a narrow opening or slit in the cylinder F; in this case the arms of the cylinder must be so arranged as to give the necessary strength to the parts so divided. One end of a long piece of printing cloth *f*, is fixed to one roller, and the other end is fixed to the other roller: there is a small ratchet-wheel on the spindle of each roller, and a click or pall (fixed on the carriage or cylinder) falls into the ratchet: when the cloth is first put on, it is wound up on one roller as far as it will go, and retained there by the click and ratchet. When the cloth becomes blackened by use, or begins to "set off" (as the printers term it), a portion of the cloth is unwound from one roller, and wound up on the other. The ends of the spindles of the rollers are square, and are turned by a loose handle or key. If very thin cloth be used in the above invention, it will be necessary to fix another cloth between it and the cylinder, in the usual manner; and although fine woollen cloth is the article referred to in the above description, we do not limit our-

selves to the use of such fine woollen cloth, but avail ourselves of any other suitable fabric; yet such fabric forms no part of our invention, and being well understood, needs no further description.—In witness whereof, &c.

Enrolled January 18, 1831.

LAW REPORTS OF PATENT CASES.

Vice-Chancellor's Court, Westminster, Thursday, January 23, 1834.

Russell *v.* Barnsley.

Mr. Knight moved the court to dissolve the injunction obtained by the plaintiff on the 15th of April last, to restrain the defendant from selling or manufacturing iron pipes or gas tubing upon a principle similar to that for which a patent had been obtained by C. Whitehouse, now assigned to the plaintiff. The learned counsel having read the affidavits upon which the injunction was granted, proceeded to contend, that if there are several modes of doing the same thing for which a patent is obtained, the patentee is bound to communicate to the public, in his specification, each of those modes: one mode of use may be more suitable or more cheap than another, and, therefore, a patentee is bound to state such various modes, whenever the process can be performed by more ways than one. His Honour having expressed an opinion, during the argument, against the dissolution of the injunction, the learned counsel moved that the question might be sent for trial, on the ground of the want of novelty in the patent, and the insufficiency of the specification. The defendant had not the power of bringing the action; it must be brought by the plaintiff. The matter was purely a question of law, respecting the validity of the patent.

Mr. Knight then read the affidavits, disputing the originality of plaintiff's patent, and the validity of

the specification. The affidavits stated, that the original inventor of the mode of welding iron tubes, claimed by the plaintiff, was a person of the name of Willis; that in or about November, 1830, the defendant entered into an arrangement with the said Willis, whereby it was agreed that he (the defendant) should himself retire from the trade of manufacturing iron tubes, which were to be manufactured by Willis, upon his new principle, the defendant supplying the means for such manufacture. That the process used by Willis was a considerable improvement upon the old system of welding iron tubes; that such improvement was originally invented by Willis, and that he has since been in the habit of manufacturing them upon such principle.

Mr. Knight admitted that the process used by the defendant would be an infringement of the patent, if it was good and valid in law. The affidavits further stated, that a person of the name of Cooke, of Birmingham, has for many years been in the habit of manufacturing iron tubes upon the principle described in the invention. The learned counsel said, that a part of what was explained by the plaintiff's specification, is a plan of welding, by passing the iron, while in a state of fusion, through grooves, holes, or dyes; and that this very thing appears to be contained in a specification enrolled so long ago as the month of March, 1808: that therefore the patent claiming too much, is void: that as the process of passing the tubes through grooves, dyes, or holes, is a part of what the specification claims, and the same having been long previously claimed, the present patent cannot stand.

His Honour observed, that the plaintiff's process was a very different thing from that described in the second part of Cooke's specification.

Mr. Knight proceeded in reading the affidavits.—That there is not any material difference between the process used by the defendant, and the principle claimed in the pretended invention; that if there be a difference the

same is not material, except that the mode used by Willis is the best. That having been restrained from making or using the said iron tubes by the injunction, defendant has incurred great and heavy loss, and therefore prays that the said injunction may be dissolved. The learned counsel observed, that the defendant admitted that the principle used by him was the same as that claimed by the plaintiff; that though they differed in some particulars, it was in fact the same principle. This mode of manufacture has been used by others, particularly by Willis; that it is no new invention; and that therefore upon that ground the patent ought not to stand. There was a further ground of objection—that the specification was bad because it does not describe the mode of carrying the new principle into effect; that if there are two modes of carrying that principle into effect, they must both be stated; it will not do to state the one and not the other. Cooke's patent, it is quite clear, does include the passing the imperfectly welded tubes through grooves or dyes. The plaintiff, in his specification, admitted that the same thing may be carried into effect in several ways, but only explains two of those ways; this of itself would be a fatal objection to the patent altogether. If the plaintiff had meant to disclaim the passing these tubes through grooves or dyes, it was his duty to have stated so; that as the principle described in the specification was an invention including several parts, some of them old and some of them new, he must state which is old and which is new. The plaintiff's specification is just such a specification as would have been described if no tubes had ever been drawn through grooves before. There were, therefore, two grounds upon which this specification must fail; and there is, besides these, a want of originality in the invention. He trusted that this matter would be sent for trial, and it was for the court to say what is to be done in the interim. The legal right of plaintiff has never yet

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been established against defendant; the trial of *Russell v. Cowley** will not decide it. The learned counsel therefore submitted that the plaintiff should be put into such a position, as would oblige him to bring the action against defendant, as defendant cannot bring the action against plaintiff.

His Honour said it appeared to him, that the plan described in Whitehouse's specification, of taking the iron, while in a state of fusion, immediately from the furnace, and passing them through the dye, was very different from that which had been described in the affidavits.

Sir Edward Sugden appeared for the plaintiff. He said that in the first place, there was no attempt to deny that the defendant had been using the process claimed by the plaintiff; his learned friend had admitted that. The learned counsel proceeded to argue against the case being sent to trial on the ground of the length of time the patent had been in use. The patent has been in use eight or nine years; and when a patent has been in use for so long a period the court, he conceived, would not, upon slight grounds, put the parties to the inconvenience and expense of sending it for trial. In the last case which had come before the court, the case went for trial, the great contest being infringement or no infringement; but now the only question which is raised is, not of infringement, but of novelty. If the court had any doubts about the patent,—if it had any fear whether there had been an infringement committed, then the case would be very different; but the plaintiff has a right to say, if my patent has been a number of years in operation, and it has been continually before the public, and tried in every way, and many attempts have been made to avoid it, then it is the law of this court, not merely that the injunction should not go, but that the trial should

* A case about to be tried in a court of common law against other infringements.

not be had. This case is not, like that of *Russell* v. *Cowley*, a question of infringement, but, whether it is an invention or not; and for this purpose they put forward three particular affidavits: plaintiff had answered those two points. It had been sworn on the part of the plaintiff, that the processes described in the defendant's affidavits were altogether different from that of plaintiff. He submitted that the court would not let them go to law, because of their long acquiescence; on this ground, the court, he was convinced, would not let them go to law. There was not the slightest doubt but that the question of novelty, if not directly, would indirectly, be decided in the trial of *Russell* v. *Cowley*; therefore, in the contest which was now taking place, defendant need not be under any apprehension that every attempt would not be made to overthrow the validity of the patent; the patent they might depend would be thoroughly sifted. He (Sir E. Sugden) did not know how it was, but there appeared to be an excellent understanding between the defendant in this case and the defendant in that of *Russell* v. *Cowley*. Somehow or other the one party always knows what the other is doing; no one party takes a step which all are not acquainted with. There appears to be an uncommon good understanding between the parties; he did not know how to account for it. If upon that trial plaintiff should be beaten, upon the ground that the new principle claimed by the patent is no new principle, then defendant can come of course upon that ground and move the court to dissolve the injunction. He submitted, therefore, that the court would not grant a trial in this case, because it would be attended by great inconvenience and expense to plaintiff to have two trials on the same subject going on at the same time by two different parties. The trial of *Russell* v. *Cowley* will enable the court to form its opinion at once on the question, and enable defendants to form their opinions also. If a party will take upon himself after an eight years' enjoyment of a patent to pirate

that patent, he must not be surprised that an injunction should be granted, and that the court should refuse to send the matter for trial. But defendants had thought proper, besides the question of want of novelty, to raise the question of the insufficiency of specification: the truth is, there is not the slightest ground to impeach this specification upon the face of it, for plaintiff does shew different modes of carrying the same thing into effect; and it is further stated that the patent is not for the mode of manufacture, but for a principle. The question of infringement having been decided, the only question therefore now is whether there is to be a trial or not. The case of *Russell* v. *Cowley* is now pending, let defendants wait the result of that trial. They (defendants) need not be afraid of throwing in their weight into that action: the defendants in that action will be glad of any little addition they may throw in against the patent. It was rather an unusual course, when one party was prosecuting an action with all the vigour possible, that another party should step in and say, "Let me have an action also." He trusted therefore that the court would not now direct the action to be brought, but would await the result of *Russell* v. *Cowley*.

Mr. Campbell followed briefly on the same side. The defendants had stated that the original invention belonged to Willis, and that it had afterwards been patented by Cooke, of Birmingham. The person named Willis, who had been represented as the original inventor of the process in dispute, was now in defendant's own workshop, and yet he had not put him in to swear (which no doubt they would have done had there been any truth in the assertion) that he was the original inventor. He need not trouble the court at any length with observations in regard to Cooke's patent, to prove that that patent is very different from the one now in dispute. The learned counsel then stated the three modes described in Cooke's specification, and pointed out the difference between them and that of

the plaintiff's patent. He apprehended that the present case was perfectly distinguishable from those cases in which the court were in the habit of referring the question to a trial at law. The learned counsel read and commented on the judgment of Lord Eldon, in the case of *Hill* v. *Thompson*, to shew what constituted sufficient ground for sending a case to a trial at law. He conceived that the proper way for the court to deal with this case would be to refuse the defendant's request to send the matter to trial, and to continue the injunction.

Mr. Knight replied. His Honour having expressed his opinion in favour of the continuance of the injunction, he would not trouble the court with any further observations on that point. He would ask was the right of a third party to be bound by a trial pending between two other parties? Is the present case to be settled before there has been any discussion at all on the points raised by the defendant? He was willing to put the case as though the trial of *Russell* v. *Cowley* had been decided, and decided in favour of the plaintiff. Had his client no right to try the question upon the grounds he had stated to the court, of the want of novelty, and insufficiency of the specification? He therefore prayed the court to refer this matter to a trial at law, in order that these questions may be fairly discussed.

His Honour, after referring to Lord Eldon's judgment, in the case of *Hill* v. *Thompson,* (2 B. Moore's Reports, 456,) said, It would not at all follow, that because it appeared to him, at present, that the patent is good and valid, that there might not be a different view of it taken by a court of law; and he apprehended that the legal view of the thing is, that it must not bind the court; and he presumed, that if the plaintiff have a trial at law—

Sir E. Sugden put it on the pendency of the other trial.

His Honour, at present, did not know enough of that case to be able to say, that what will happen in that case,

will determine this; it appeared to him, therefore, that the injunction must be continued until further orders, and on the plaintiff undertaking to bring an action within three months.

PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

Economical Observatory for Private Students and Cultivators of Astronomy.—The following is an account of a small observatory, recently erected at Biggleswade, in Bedfordshire, by Mr. Maclear, a zealous cultivator of astronomical science, and communicated by him (in a letter to Mr. Stratford, the superintendent of the Nautical Almanac) to the Astronomical Society, from the sixth volume of whose Memoirs, newly published, we now extract it. We have been induced to transfer it to our pages from the consideration that it may prove highly useful to engineers, architects, and others, who may be called upon to design or superintend the erection of private observatories.

Mr. Maclear has been obliged, he states, to suit his astronomical amusements to economy and convenience rather than to his wishes.—The little transit-room, he observes, Mr. Stratford has seen. Last December he took down the clock, and put up a stone pillar, with stone brackets let into it, which, passing through apertures in the back of the clock-case, support the clock independent of the case. The rising-board of the clock is fixed on these stones by iron bolts and screw-heads soldered into them.—Mr. Maclear has also erected a small room for the telescope, to reap the advantage of its equatorial mounting; and, from local difficulties, he has been under the necessity of making it higher in proportion to its breadth than it should be. It is an octagon building of wood, viz. deal panel-work, at one shilling per foot.

Ground Plan.

Transit Room, 8 *feet square. Room with rotatory roof,* 8 *feet in diameter.*

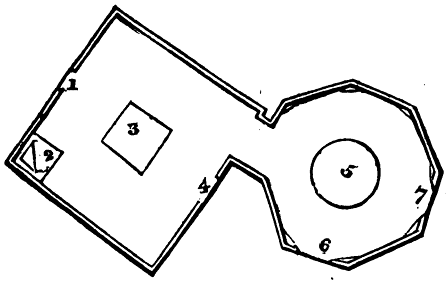
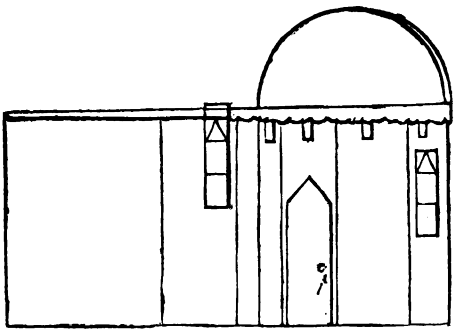


Fig. 1. *Window.*
2. *Clock.*
3. *Transit.*
4. *Window.*

Fig. 5. *Telescope stand.*
6. *Door.*
7. *Window.*

The diameter of the inscribed circle of the octagon is nearly eight feet; it is nine feet high, surmounted on the top by a circular plate of deal, four inches thick, composed of circular segments screwed together, the ends of the segments uniting in the middle of a segment alternately above and below, thus  The plate is covered on its upper surface with sheet-iron for the rollers to move on; likewise the inner edge is covered with the same, for eight friction-rollers from the plate of the dome to run against. It is strengthened alternately within and without by eight brackets, one at the middle of each side of the octagon, screwed to the panel-work and plate. Also each inner angle of the octagon is strengthened with a triangular plank closely fitted and screwed on.

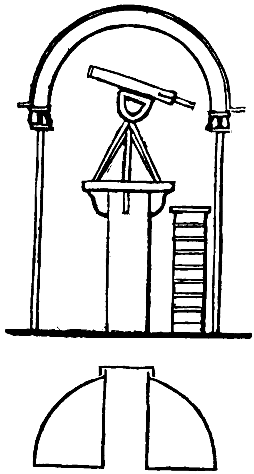
Orthographic Elevation.



The dome is meant to be a perfect hemisphere, and it is nearly so. It is composed of a plate exactly of the size and strength of that on the panel-work, carrying eight conical rollers of box, and eight friction-rollers of iron, on strong iron arms. These friction-rollers having their axes vertical, and turning on the inner edge of the lower plate, keep the dome in its place.

The ribs of the dome are screwed into this plate, and are covered with very thin white deal slabs, protected from the weather by painted canvas. The opening in the dome is eighteen inches wide, and extends, without interruption from the zenith to the horizon. Mr. Maclear's object in having the dome hemispherical, was, that the opening might be covered by a sliding sheet exactly a quadrant of a circle; for this purpose an edging one inch and a half high rises above the surface of the dome on each side of the slit, and is continued to the opposite horizon, viz. 180°; it is covered with hoop iron. The circular shutter has edging to overlap the former; and small brass rollers are fixed to its inner side, to move on the edging of the dome. With this contrivance, and the aid of a few pulleys—one of them carrying a counterpoise—the slit is easily opened in part, or to its whole extent, the shutter sliding a corresponding quantity over the dome. One of the advantages resulting from this contrivance is, that the dew may always be kept off the object-glass.

Section shewing the Telescope, Stand, and Steps.



A solid oak plank, eighteen inches diameter, is fixed three feet in the ground, and five feet out of it; this supports the telescope in a high wind without the slightest tremor; and, from its specific gravity, will answer as well as brick-work, possessing many advantages over the latter as to fixing the telescope, &c. With a pair of moveable steps, Mr. M. can stand or sit when observing. The total expense of this little room was fifty pounds.

Selection of Earthy Matter by the Roots of Plants.—In the Philosophical Magazine for January we find an abstract of a paper by Dr. Daubeny, Professor of Chemistry in the University of Oxford, which was read before the Linnæan Society on the 19th of November and 3d of December last, entitled, "On the Degree of Selection exercised by Plants with regard to the Earthy Constituents presented to their absorbing Surfaces." This paper, which is altogether experimental, bears directly on the theory of the absorption of nutriment in general by plants, and tends to illustrate and explain a portion of the theory of manures, as given in our last number, Progress of Science, &c. p. 30.

The author states that he was first led into this train of experiment with the hope of ascertaining, by more decisive experiments than had been hitherto done, whether plants are able, under any circumstances, to form those earthy and alkaline matters which they usually contain, when not supplied with them from without.

With this view, he planted a known weight of the seeds of certain vegetables in earths of known composition, introduced, in a finely divided state, into boxes cased internally with sheet zinc. One box, containing each kind of earth, was placed in a garden exposed to rain and dust, and a corresponding one of each kind in a green-house protected from both. The earths employed were, washed sea-sand, Carrara marble, and sulphate of strontian.

The crop obtained from each of the boxes was separately burnt, and the ashes weighed and examined chemically. That from the boxes placed in the garden was greater than that from those in the green-house; but in both cases an increase of earthy matter was observed beyond that which existed in the seeds from which they had sprung.

Having remarked, however, that the plants grown in strontian contained none of that earth, he resolved to try whether this circumstance might be owing merely to the insolubility of the sulphate in water, or to some specific power, belonging to the plant, of rejecting the earth in question.

He therefore varied the experiment the succeeding year, by planting the seeds in four different soils, namely, sand, marble, sulphate of strontian, and flowers of sulphur, and watering them with a weak solution of nitrate of strontian. In every instance there was an increase of calcareous matter, beyond that present in the seeds, greatest in the plants that had grown in sulphate of strontian and in Carrara marble, least in those planted in sulphur; but the largest quantity of strontian ever detected by chemical means from their ashes did not exceed 0·4 of a grain.

From these and similar experiments detailed in the memoir, the author concludes that the absorbing surfaces or spongioles of the roots of plants either do not admit of strontian earth at all, even in a state of solution, or at least receive it much less readily than they do calcareous matter.

He details an experiment to show that the absence of strontian from the solid parts of the plants was owing to its remaining unabsorbed by the roots, not to its being excreted by them; and accounts for the difference between what happened in the instance of the strontian, and that which he had himself observed in common with Mons. de Saussure, as holding good with regard to solutions of substances more directly injurious to the plant, by supposing, in the latter instance, the spongioles to be disorganized by the poisonous quality of the substance, and consequently to have allowed the solution to be absorbed by capillary attraction. In this latter case he observed, that before the plant is destroyed, a portion of the poisonous substance will be excreted again by the spongioles of the roots.

Upon the whole he concludes, that his experiments lend no countenance to the idea that plants can form earthy constituents when not supplied with them from without, although they do not altogether demonstrate the reverse. They seem, however, to show more decisively that plants do, to a certain extent at least, possess a power of selection, and that the earthy constituents which form the basis of their solid parts are determined as to *quality* [*kind?*] by some primary law of nature, although their *amount* may depend upon the more or less abundant supply of the principles presented to them from without.

Determination of the Plant which yields the Gum Ammoniacum.—Mr. D. Don, of the Linnæan Society, has at length ascertained the plant which furnishes this important drug. The following particulars on the subject are derived from a paper by that distinguished

botanist, published in the Transactions of the Linnæan Society, vol. xvi.

Although the gum Ammoniacum has held a place in the Materia Medica from a very early period, yet the plant from which it is obtained has hitherto remained almost totally unknown; and the same may be said of the analagous gum Galbanum, and many other articles derived from the vegetable kingdom enumerated in the Pharmacopœia. It is true, Dioscorides and Pliny mention the plant which yields the gum Ammoniacum; the former under the appellation of *Agasyllis*, and the latter under that of *Metopium*, and give Libya as its native country: but if the gum was anciently imported thence, it must have been the produce of a different plant from the one which Mr. Don describes, and probably identical with the species of *Ferula* represented by Jackson in his account of Morocco; as the gum now comes to Europe by way of the Levant and India. Dioscorides, whose opinion is adopted by all subsequent writers, derives the name *Ammoniacum* from Ammon or Hammon, the Jupiter of the Libyans, whose temple was situated in the desert of Cyrene, near to which the plant was said to grow. It appears, however, to Mr. Don, that Dioscorides was altogether mistaken as to its native country, and that the name Ammoniacum, or Armoniacum, as it is indifferently written, is really a corruption of Armeniacum, for it is now ascertained beyond all doubt that the plant is a native of Persia, and that the gum must have anciently been brought to Europe by way of Armenia; and we find in ancient authors the name of the apricot sometimes written *Malum Armoniacum*.

Willdenow fancied he had obtained the plant itself; for having sown some seeds picked from the gum Ammoniacum, a species of *Heracleum* came up, of which he has published a figure and description in the "*Hortus Berolinensis*," under the name of *H. Gummiferum;* but as the plant possesses no smell analogous to Ammoniacum, and affords no gummy substance whatever, it is probable it

was only an accidental weed, as it does not appear to be specifically different from *Heracleum pyrenaicum.*

The materials from which Mr. Don drew up his description were procured by Lieut.-Colonel Wright of the Royal Engineers, in the district where the gum Ammoniacum is collected, namely, in the vicinity of Jezd Khāst, a town of Irāk El Ajam, the ancient Parthia, about forty-two miles south of Ispahan, and presented by him along with other dried plants to the Linnæan Society. Every part of the specimen is covered with drops of a gum possessing all the properties of Ammoniacum; and this circumstance alone, independent of any other evidence, would seem sufficient to remove all doubt on the subject; but, besides, the specimen has been carefully compared with the portions of inflorescence and fruit which are found abundantly intermixed with the gum in the shops, and found to agree in every particular. The name applied to the plant by Dioscorides is already preoccupied by another genus of *umbelliferæ;* and that of Pliny is scarcely unexceptionable, as originating in a mistake, *Metopium* having been used by some ancient authors to denote the Galbanum, and by others the gum Arabic tree; but most writers seem to agree in considering it the appellation of an ointment, or some oleaginous substance, rather than of a plant. To avoid any confusion, and as the plant proves to be a new genus, Mr. Don proposes to call it *Dorema,* from the Greek word δωρημα, a gift or benefit; not that he considers the Ammoniacum plant as pre-eminently deserving that title, but the name is at least a short one, and agreeable to the ear,—considerations not to be overlooked in nomenclature. He next proceeds to give the essential character and a detailed description of the genus. It belongs to the *Pentandria Digynia* of Linnæus, to the natural order *Umbelliferæ* of Jussieu, and to that group of the latter called *Peucedanæ* by De Candolle. Its large cup-shaded epigynous disk, and solitary resiniferous canals distinguish this genus from *Ferula* and *Opopanax* to

both of which it is closely allied. Its flowers being completely sessile is also a remarkable character.

After drawing up the preceding observations, Mr. Don was enabled to add the following information on the subject.

The first volume of the *Dictionnaire Universel de Matière Médicale*, by Mérat and De Lens, published at Paris in 1829, contains some valuable notices on the Ammoniacum plant, from which it appears that the plant was already known to Mr. Brown, and had been determined by him to constitute a new genus. We also learn from the same work, that M. Fontanier, a geologist sent into the Levant by the French government, had visited the district where the plant grows spontaneously, and transmitted a drawing, together with specimens of the herb and gum, to the Museum of Natural History at Paris. M. Fontanier was informed that the plant grows likewise in Khorāsān.

In the Appendix to the first volume of the Transactions of the Medical Society of Calcutta, p. 369, is an extract from a letter addressed to Dr. Wallich, by Lieut.-Colonel Kennett, accompanied by a rude figure of the plant which yields the gum ammoniacum, of which the following is a copy:—

"I have the pleasure to forward you a drawing and description of the *Oshac*, a Persian plant, that produces the gum ammoniac. It was procured by Captain Hart (of the 5th battalion Bombay native regiment) whilst on sick certificate in Persia; and, understanding it was a desideratum in botany, he has requested me to send it to you in his name. It is to be regretted that Captain Hart did not know enough of botany to give a particular description of the plant, flowers, and seeds; but he brought away a root, with a piece of the stem and some dry leaves attached, and which I have forwarded in a box to your address. You will observe the account of the plant is dated in July, 1822, though I only received it a short time ago.

" '*Description of the Oshac, or Gum Ammoniac Plant.*

" 'It having been intimated to me while at Bushire, by the president, Captain Bruce, that the plant which produces the gum ammoniac,—called by the Persians *Oshac*,—would be acceptable to botanists, as it was but imperfectly known, I procured the accompanying piece of stem, leaves, and flower, and took a drawing of one of the finest plants. Its height was seven feet two inches, and the circumference of the lower part of the stem four inches. It grows principally on the plains between Yerdekaust and Kumisha, in the province of Irauk, without cultivation. The gum is so abundant, that, upon the slightest puncture being made, it instantly oozes forth, even at the ends of the leaves. When the plant has attained perfection, innumerable beetles, armed with an interior and posterior probe of half an inch in length, pierce it in all directions; it soon becomes dry, and is then picked off, and sent *viâ* Bushire to India and various parts of the world, and is an article of considerable export. I am of opinion it might be cultivated with success in many parts of Kattyawar, and the experiment might be worth the consideration of Government. The gum might easily be procured by artificial means, which would answer the purpose equally well.

" 'From the part of the stem attached to the roots of the specimen I sent you, a considerable portion of the gum will be seen exuded, in which respect it resembles the Assafœtida plant, which abounds in the mountains in the south of Persia, particularly in the province of Lar.' "

The gum is collected about the middle of June, a tenth is remitted as tribute to the Government, the rest is sent to Bushire on the Persian gulf, and thence to Europe. Part of that imported to this country came from the Levant; but Mr. S. F. Gray, F.L.S. informs me that the largest quantity and the best comes by way of India.

The following additional particulars were communicated

to Mr. Don by Major Willock, who has visited the districts where the plant grows wild.

"The *Ooshăk*, or gum Ammoniacum plant, grows in great abundance over the arid plains in the vicinity of the town of Jezud Khăst, on the borders of the provinces of Fars and Irak. Jezud Khăst is a district appertaining to the Government of Ispahan. The plant is perennial, and throws up from the root a cluster of leaves, and one or more strong vigorous naked stems, of three or four feet in height, divided into joints of five or six inches long, throwing out various branches of equal length. The white juice which forms the gum pervades the whole plant, but exudes chiefly from the principal stems. It either remains on them in lumps, or, falling to the ground, is gathered by the villagers in the autumn, and is sold by them.' The *Ooshăk* plant is to be met with no where but in the province of Irak, growing in very dry plains, gravelly soils, and exposed to an ardent sun."

Determination of the Plant which yields Gum Galbanum.—With respect to the plant which yields the gum Galbanum, Mr. Don is enabled to say but little, not having seen any part of it except the fruit, some of which, almost perfect, he has been so fortunate as to pick from the gum. These, however, are quite sufficient to determine the most important characters of the plant, which appears to constitute a new genus allied to *Siler*, but differing essentially from it in the absence of dorsal resiniferous canals, and the commissure being furnished with only two. He proposes for the plant the appellation of *Galbanum officinale*, and gives a technial description of the fruit.

The plant, according to Dioscorides, is a native of Syria; but it must be in some remote and inaccessible part of it, as it has not been observed by any of the numerous travellers who have visited that country. As the gum is partly imported from Smyrna, and partly from India, it is very probable that the plant is also a native of Persia.

The *Bubon Galbanum* of Linnæus possesses neither the smell nor the taste of Galbanum, but in these particulars agrees better with Fennel, and the fruit has no resemblance whatever to that found in the gum. How a plant differing so essentially from Galbanum should yet have been retained so long in the Pharmacopœia may well be a subject of surprise, especially as the *Bubon Galbanum*, being so frequent in botanical collections, afforded abundant opportunities of settling the question.

Alleged Discovery of Coal at Billesdon, Leicestershire.—Since the publication of our last number, in which, pp. 39—41, we noticed the observations of the Rev. W. D. Conybeare and of Professor Sedgwick on this subject, a more particular account has appeared of the researches of the latter geologist on the structure of Charnwood Forest, as communicated to the Philosophical Society of Cambridge. From this we derive the following additional notice of the attempt to discover coal recently made at Billesdon. The subject continues to be one of great importance, for (notwithstanding the explanations, warning, and remonstrances of geologists), landholders and others, deceived by the appearance of imperfectly bituminized substances, and misled by designing speculators, persist in operations for the discovery of coal, in various tracts of country, the only result of which will be the certain loss of the large sums expended in them. We are inclined to think, however, that one mode of demonstrating the fallacy of the appearances which give rise to these fruitless searches, which would probably be more efficacious than any other, has been omitted by geologists who have treated on this particular subject; on which account we purpose to return to the subject in a future number, adopting the mode of explanation to which we here allude.

In the first part of Professor Sedgwick's paper were considered the relations of the rocks of Charnwood Forest to those of the neighbouring districts. The phænomena were

illustrated by sections. It was shown, that the coal fields on the west side of the Forest were under the new red sandstone; that the Forest is almost surrounded by a plain of red marl and sandstone, resting unconformably on the edges of the older strata, and that the lias and inferior oolites overlie the red marl in regular order, forming a remarkable feature on the east side of the county. Hence the author asserted, that the works carried on at Billesdon Coplow in search of coal, had been undertaken in entire ignorance of the stratification of the country, and that in a published report by a mineral surveyor, the marlstone and lower oolites (though lying over the regular lias terrace and full of fossils,) had been mistaken for the new red sandstone.—*Lond. & Edinb. Phil. Mag. Jan.* 1834.

On the Manufacture of Oil and Spirit Varnishes, Gold Lackers, Gold Size, &c. By J. Wilson Neil, 21, King's Cross, Battle Bridge.*

As this paper is intended for the information and use of those persons who know little or nothing of varnish-making, it has been deemed necessary to give the most ample and plain directions, which, at first sight, may appear superfluous to those who are a little acquainted with the business. But those who are the most competent judges will, I am certain, agree with me, that the directions cannot be too plain, ample, or particular; either as relates to the erection of furnaces, choice of pots, and the various other implements required in the trade; and still more particularly in the choice of the various mate-

* From vol. xlix. Part 2nd. of the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce. The Society voted its *Gold Isis Medal* to Mr. Neil, for this communication. Mr. Neil was, for many years, a manufacturer of varnishes, on a large scale, and his varnishes have borne a high reputation among coach-builders and others. With a most praiseworthy liberality, he has placed the results of his experience in the possession of the Society, for the benefit of the public.

rials of which varnishes are composed; together with the most simple, easy, and economical methods of conducting and performing every operation connected with the business of varnish-making.

I advise every practitioner, when he commences varnish-making, to keep a book, or "*working-journal,*" and in it to enter the day of the month and year, the quantity and quality of gum used; the quantity of oil, turpentine, and dryers; the number of hours it has boiled, the quantity of varnish produced in gallons, the number of the cistern where it is stored, and the name which is marked on the outside. Also, and particularly, whether the atmosphere was wet, cold, and dry, or very hot and dry, &c., noticing also the *day* upon which it is sent out for use. From these observations the most important information may be acquired.

Hitherto the art of varnish-making has been kept, in its details, as far as possible, a profound secret, and therefore, when thrown open to investigation, and assisted by the exertions of men of real chemical research, farther improvements may, no doubt, yet be made. That the present communication — the result of thirty years of anxious study and practical experience — may conduce to these inquiries, by stimulating the established practitioner, and urging others to the task, is the most fervent hope of the author.

Every person intending to manufacture varnish on a profitable scale, ought to procure suitable premises some distance out of town, and sufficiently large for the scale of business intended. The building, or shed, wherein varnish is made, ought to be quite detached from any other buildings whatever, to avoid accidents by fire. For general purposes, a building about 18 feet by 16 is sufficiently large for manufacturing 4000 gallons and upwards annually, if there are other convenient buildings for the purpose of holding the utensils, and warehousing the necessary stock.

On the fixtures and utensils necessary for manufacturing varnish on a scale of the above extent, I shall give the most plain and ample directions, point out the least expensive method, and afterwards leave every future operator to judge for himself of the number, size, form, and quality of the fixtures and utensils which he may require, according to his intentions and circumstances. Procure a building, or erect one, 18 feet long by 16 wide; the back wall 18 feet long and 18 high, the front 18 feet long and 9 feet high, with a door-way in the centre 4 feet wide, with folding-doors made to lift from off the hinges; let the roof slope to the front: fix also in each end-wall a frame and door 4 feet wide, and made to lift off the hinges also, so that, when necessary, there may be a free draft through the premises. Let three skylights be made, each 4 feet long by 3 feet broad, and fixed in the roof, not directly over the furnaces, but on one side, so as to throw light on the furnaces. Next, have three frames exactly the size of the frames of the skylights, well grooved and battened, with broad flaps to open on the outside, hung at the top with hinges, and capable of being raised by a spring-lever and cord inside, as occasion may require. The skylights and flaps must be well secured by lead flushings, to prevent wet getting in, which might be attended with serious consequences.

[*To be continued.*]

CRITICAL NOTICES AND REVIEWS.

A Treatise on Roads. By the Right Honourable Sir H. Parnell, Bart., Honorary Member of the Institution of Civil Engineers: Longman and Co., London.

Road making has long been one of our most favoured studies, and we had contemplated inserting a few papers on this subject, when we received information of the

present work coming from the press. The author has been some years one of the commissioners appointed by parliament to superintend the improvements on the London and Holyhead road, consequently, has had the best possible opportunity of obtaining information, and of watching the results of the various plans which have been pursued on this road.

We will not take up the time of our readers by going into an inquiry as to the national advantages derivable from every improved means of facilitating inland communication, for the conveyance of goods and persons from one part to another—of raw materials to the place of manufacture—of fuel which is so material in every branch of manufacture—of manure or one description of soil to another—the value of every improvement for effecting these objects is becoming too well understood to require more than a passing observation. Sir Henry Parnell's treatise deserves our unqualified approbation; it will certainly tend materially to advance a knowledge of this important branch of our national economy. The work is divided into twelve chapters, with a copious appendix, containing copies of specifications of works performed on various part of the Holyhead road, with the description of the soil and the consequent treatment. The author, in his introduction, thus describes the object of the work: "The obvious utility of a work on road making, explaining the principles on which this business should be carried on, and containing an illustration of those principles, by a reference to the plans, specifications, and contracts which have been made use of in constructing this extent of new road through a country presenting every kind of difficulty, has suggested the present publication. The object of it is to point out, in a clear and concise manner, the best method of tracing out and constructing roads under every variety of circumstances; and it is confidently expected, that the course which has been pursued of proceeding on experience, by referring to the identical plans,

specifications, and contracts, by which so great an extent of perfect road has been successfully made, will be found to have attained this object." The first chapter of the work relates to the rules proper for tracing out the line of a new road; in this department the author has displayed considerable judgment and ability: he observes that

"This business of tracing the line of a road should never be undertaken without the assistance of instruments; and all local suggestions should be received with extreme caution.

"To guard against errors in this important point, it is essentially necessary not to trust to the eye alone, but in every case to have a survey made of the country lying between the extreme points of the intended new road. For this purpose an experienced surveyor should be employed to survey and take the levels of all the various lines that, on a previous perambulation of the country, appear favourable. It is only by such means that the best line can be determined. These surveys should be neatly and accurately protracted, and laid down on good paper, on a scale of sixty-six yards to an inch for the ground-plan, and of thirty feet to an inch for the vertical section.

"The map should be correctly shaded, so as to exhibit a true representation of the country, with all its undulations of high grounds and valleys, streams and brooks, houses, orchards, churches, ponds of water adjacent to the line of road, and all other conspicuous objects should also be laid down in the map. A vertical section should be made, and the nature of the soil or different strata should be shown over which each apparently favourable line passes, to be ascertained by boring; for it is by this means alone that the slopes, at which the cuttings and embankments will stand, can be determined and calculated. If it be necessary to cross rivers, the height of the greatest floods should be marked on the sections; and the velocity of the water, and the sectional area of the river should be stated.

"If bogs or morasses are to be passed over, the depth of the peat should be ascertained by boring; and the general inclination of the country for drainage should be marked.

"All the gravel-pits or stone quarries contiguous to the line should be described on the map, with the various roads communicating with them; and the existing bridges over the streams or rivers which are immediately below the proposed point of crossing them, should be carefully measured, and the span or waterway stated on the section.

"These preliminary precautions are absolutely necessary, to enable an engineer to fix upon the best line of road, with respect to general

direction and longitudinal inclination. Without the unerring guide of actual measurement and calculation, all will be guess and uncertainty.

"It may be laid down as a general rule, that the best line of road between any two points will be that which is the shortest, the most level, and the cheapest of execution: but this general rule admits of much qualification; it must, in many cases, be governed by the comparative cost of annual repairs, and the present and future traffic that may be expected to pass over the road. Natural obstructions also, such as hills, valleys, and rivers will intervene, and frequently render it necessary to deviate from the direct course.

"In every instance of laying out a road in a hilly country, the spirit-level is essentially necessary to show the proper line of road to be selected. The general rule to be followed in surveys, is, to preserve the straight line, except when it becomes necessary to leave it to gain the rate of inclination that may be considered proper to be obtained, without expensive excavations and embankments. When a deviation is made for this purpose, it becomes necessary to proceed in a direct line from a new point.

"When expeditious travelling is the object, the maximum rate of inclination that never should be exceeded in passing over hills, if it be practicable to avoid exceeding it, is that which will afford every advantage in descending hills, as well as in ascending them. For, as carriages are necessarily retarded in ascending hills, however moderate their inclinations may be, if horses cannot be driven at a fast pace in going down them, a great loss of time is the result. This circumstance is particularly deserving of attention, because the present average fast rate of driving over any length of road, can be accomplished in no other way than by going very fast down the hills. But when the hills are very steep, and a coachman cannot keep his time, except by driving very fast down them, he exposes the lives of his passengers to the greatest danger.

"How much time is lost in descending steep hills, will appear from the following statement:—Suppose a hill to be so steep as not to admit of a stage-coach going faster down it than at the rate of six miles an hour, five minutes will be required for every half mile: but, if the hill were of an inclination of 1 in 35, it might be driven down with perfect safety at the rate of twelve miles an hour; at which rate the time for going half a mile would be two minutes and a half, so that there is a loss of half a mile in distance, for every half mile down the steep hill.

"An inclination of 1 in 35 is found, by experience, to be just such an inclination as admits of horses being driven in a stage coach with perfect safety, when descending in as fast a trot as they can go; because, in such a case, the coachman can preserve his command over them, and guide and stop them as he pleases. A practical illustration

that this rate of inclination is not too great, may be seen on a part of the Holyhead road, lately made by the parliamentary commissioners, on the north of the city of Coventry, where the inclinations are at this rate, and are found to present no difficulty to fast driving, either in ascending or descending. For this reason it may be taken as a general rule, in laying out a line of new road, never, if possible, to have a greater inclination than that of 1 in 35. Particular circumstances may, no doubt, occur to require a deviation from this rule; but nothing, except a clear case that the circuit to be made to gain the prescribed rate, would be so great, as to require more horse labour in drawing over it, than in ascending a greater inclination, should be allowed to have any weight in favour of departing from this general rule. On any rate of inclination greater than 1 in 35, the labour of horses in ascending hills, is very much increased. The experiments detailed in the Seventh Report of the Parliamentary Commissioners of the Holyhead Road, made by a newly invented machine for measuring the force of traction or power required to draw carriages over different roads, fully establish this fact."

The author then notices the variety of difficulties and obstacles which continually occur in making choice of a line of road, such as rivers, hills, bogs, and marsh grounds, on each of which he gives very judicious advice; but we proceed to the chapter, where the principle which governs wheel carriages in their motion on roads is treated of.

"The question to be examined and decided, is, how a carriage, when once propelled, can be kept moving onwards with the least possible quantity of labour to horses, or of force of traction?

"Sir Isaac Newton has laid it down as a general principle of science, that a body, when once set in motion, will continue to move uniformly forward in a straight line by its momentum, until it be stopped by the action of some external force. This proposition is admitted and adopted by all natural philosophers as being perfectly true, and, therefore, in order to apply it to roads, it is necessary to inquire what kinds of external force act in a manner to diminish and destroy the momentum of carriages passing over them. With respect to these external forces, the general doctrine is, that they consist of 1st, collision; 2nd, friction; 3rd, gravity; and 4th, air.*

"1st, The effect of collision is very great in diminishing the momentum of carriages; it is occasioned by, and is in proportion to, the hard protuberances and other inequalities on the surface of a road. These occasion, by the resistance which they make to the wheels,

"* See Wood's Mechanics, p. 20."

jolts and shocks, which waste the power of draught, and considerably check the forward motion of a carriage.

"2nd, Friction has a very great influence in checking the motion of a carriage; for, when the wheels come into contact with a soft or elastic surface, the friction which takes place operates powerfully in obstructing the tendency of the carriage to proceed; the motion forwards is immediately retarded, and would soon cease, if not renewed by the efforts of the horses. The "resistance," Professor Leslie says, "which friction occasions, partakes of the nature of the resistance of fluids; it consists of the consumption of the moving force, or of the horse's labour, occasioned by the soft surface of the road, and *the continually depressing of the spongy and elastic sub-strata of the road.**"

"An ivory ball, set in motion with a certain velocity over a Turkey carpet, will suffer a visible relaxation of its course; but, with the same impelling force, it will advance further if rolled over a superfine cloth; still further over smooth oaken planks; and it will scarcely seem to abate its velocity over a sheet of pure ice.

"This short explanation of the nature and effects of collision and friction is sufficient to shew, that smoothness and hardness are the chief qualities to be secured in constructing a road. But perfect smoothness cannot be obtained without first securing perfect hardness; and therefore the business of making a good road may be said to resolve itself into that of securing perfect hardness.

"With the view of taking the right course for securing this object, the first thing a road trustee or engineer should do, is, to form a correct notion of what hardness is; because the common habit of overlooking this circumstance has been the source of great error in forming opinions upon the qualities of different kinds of roads.

"Gravel roads, for instance, to which an appearance of smoothness is given by incurring a vast expense in scraping them, and patching them with thin layers of very small gravel, are very commonly declared to be perfect. and unequalled by any other kind of road. But if the best gravel road be compared with one properly constructed with stone materials, the hardness of the former will be found to be greatly inferior to that of the latter, and the error of the advocates of smooth-looking gravel roads will be immediately made manifest.

"That an elastic subsoil is unfit for a road is evident from the nature of the resistance occasioned by friction, as above described by Professor Leslie, and from the terms of the definition of hardness; for however strong the crust of materials may be which is formed over such a subsoil, it will not be capable of opposing a perfect resistance

"* Elements of Natural Philosophy."

to a heavy moving body. The moving body will sink more or less in proportion as the subsoil is elastic, and the hardness of the road will be imperfect in proportion as this sinking takes place; so that nothing can be more necessary, as a preliminary step in making a new road, than to take every possible precaution to avoid elastic subsoils, or to destroy the elasticity as much as possible, when no other can be found.

"After the engineer has prepared a proper substratum of earth for the bed of a road, he next must construct a crust of road materials in such a manner, that, when consolidated, it shall possess such a degree of hardness as will not admit the wheels of carriages to sink or cut into it. For this purpose it will not be sufficient to lay upon the prepared bed of earth merely a coating of broken stones, for the carriages passing over them will force those next the earth into it, and, at the same time, press much of the earth upwards between the stones: this will take place to a greater degree in wet weather, when the bed of earth will be converted into soft mud by water passing from the surface of the road, through the broken stones, into the bed of the road. In this way a considerable quantity of earth will be mixed with the stone materials laid on for forming the crust of the road, aud this mixture will make it extremely imperfect as to hardness.

"Mr. Telford's plan, which has completely succeeded on the Holyhead road, the Glasgow and Carlisle road, and several other roads in Scotland, of making a regular bottoming of rough, close-set pavement, is a plan that secures the greatest degree of hardness that can be given to a road; it is also attended with much less expense than when a thick coating of broken stones is used; for six inches of broken stones is sufficient when laid on a pavement, and the pavement may be made with any kind of common stone.

"By laying the stones, in making the bottoming, with their broadest face downwards, and filling up the interstices closely with stone chips well driven in, the earthy bed of the road cannot be pressed up so as to be mixed with the coating of broken stones. This coating, therefore, when consolidated, will form a solid uniform mass of stone, and be infinitely harder than one of broken stones, when mixed with the earth of the substratum of the road. It is by proceeding in the way here recommended, that the friction of wheels on a road will be reduced as much as possible.

"To comprehend thoroughly the great importance of making a regular and strong foundation for a road, it should be borne in mind, that roads are structures that have to sustain great weights and violent percussion; the same rules, therefore, ought to be followed in regard to them, as are followed in regard to other structures.

"In building edifices which are to support great weights, whether a church, a house, or a bridge, the primary and indispensable consideration of the architect is to obtain a permanently firm and stable foundation; well knowing that unless this be first substantially made, no future dependance can be placed on the stability of the intended superstructure: but this most requisite precaution has but recently been attended to in the formation of roads, and only on those roads in Scotland, and between London and Holyhead, which have been under the direction of Mr. Telford.

"If the foundation of a road be not sufficient and equal to the pressure it has to sustain, the whole fabric, though in other respects ever so well constructed, must fail in permanent stability, and the hardness of it will be imperfect from its elasticity.

"Having now stated all that the rules of science, relating to moving bodies, suggest, in order to defend the principles of road making, which have been laid down as the proper principles to be adopted, we shall now proceed further to illustrate and support these principles, by referring to experiments of the force of traction on different kinds of roads. These experiments have been made with the machine invented by Mr. Macneill.

"These experiments uniformly shew, that the force of traction is, in every case, nearly in an exact proportion to the strength and hardness of a road. The following are the results: on a well-made pavement, the power required to draw a waggon is 33 lbs.; on a road made with six inches of broken stone of great hardness, laid on a foundation of large stones, set in the form of a pavement, the power required is 46 lbs.; on a road made with a thick coating of broken stone, laid on earth, the power required is 65 lbs.; and on a road made with a thick coating of gravel, laid on earth, the power required is 147 lbs. Thus it appears, that the results of actual experiments fully correspond with those deduced from the laws of science."

The author next treats of the forming of roads, cutting, embanking, and draining, all which are exemplified by reference to plans, sections, and specifications of work performed under the direction of Mr. Telford and Mr. Macneill, the engineers to the Holyhead road; and a very long chapter is devoted to the different modes of constructing roads.

First—Iron railways.

Second—Paved roads.

Third—Roads of which the surface is partly paved and partly made with broken stones or other materials.

Fourth—Roads with a foundation of pavement, and a surface of broken stones.

Fifth—Roads with a foundation of rubble stones, and a surface of broken stones or gravel.

Sixth—Roads with broken stones laid on the natural soil.

Seventh—Roads made with gravel laid on the natural soil.

We will give a few extracts from these parts of the subject, in order, in some degree, to induce our readers to desire a more intimate knowledge of the work by reading the whole.

"The expense of constructing railways, depends upon the nature of the ground they are made over, and the purpose for which they are intended. In many situations, where the trade is altogether a descending one, and water scarce, they are preferable to canals, and may be constructed cheaper; but for general traffic over a wide extent of country, they do not afford as cheap a means of conveyance as canals.

"In some instances, railways have been constructed for 1000*l*. per mile, but in others, the Manchester and Liverpool, for instance, the expense per mile has exceeded 30,000*l*.

"It is stated in the Quarterly Review, No. lxii. p. 363, that the general average of a number of rail-roads, some tram-rails, others edge-rails, some of cast-iron, others of wrought-iron, of upwards of 500 miles extent, is, as nearly as possible, 4000*l*. per mile, allowing them a double set of tracks; and the writer very justly remarks, 'From the imperfections of these old rail-roads we may extend the average to 5000*l*. per mile.' Mr. Tredgold estimates the annual repair of a rail-road at 557*l*. per mile.

"Mr. Stephenson estimated the cost of making a rail-road from London to Birmingham, at 2,500,000*l*., or 21,756*l*. per mile; but other engineers have calculated the total expense at about 3,500,000*l*., or at 30,400*l*. per mile.

"The annual expense of keeping a rail-road in repair, depends upon the velocity with which the waggons are drawn over it. Mr. Walker, in his Report to the Directors of the Manchester and Liverpool Railroad, states, 'that, as the speed with engines is greater than with horses, the injury is greater in case of any irregularity.'

"It has been well ascertained, that rail-roads on which horses are employed, are always found in much better order and repair than those on which locomotive engines are used.

"The relative expense of transporting goods upon canals, railways, and common roads, may be estimated as follows:—From various observations which have been made on the work actually performed by horses on several railways, it may be assumed, that the greatest effect produced by horses is twelve tons gross, drawn over a space of twenty miles per day; and, as the waggons employed on railways are generally one-third of the gross weight, the net weight of the goods carried will be eight tons over twenty miles per day, by one horse, or 160 tons over one mile, at the average velocity of two miles per hour. The expense may be taken at twopence per ton per mile.

"On canals, one horse will draw a boat containing twenty-five tons of goods over a space of sixteen miles per day, at the speed of two miles and a half per hour: this is equivalent to $25 \times 16 = 400$ tons of merchandise carried over one mile per day, or two and a half times as much as on a railway. The actual expense of transporting goods by canal, is only one halfpenny per ton per mile, including boat-hire, steersman, wages, and horse-power.*

"In Scotland and Ireland, where the roads are made with broken stones, and where the practice is to use one-horse carts, the work which horses perform may be taken at 25 cwt., exclusive of the cart. But in England, where waggons are used, and the roads are not so hard, the work of horses may be taken at 15 cwt. In the latter case, the average cost is about ninepence per ton per mile, including the wear and tear of the carts, and the wages of the drivers. In some parts of the country the cost is sixpence per mile, but in other parts, as near London, it is one shilling."

On the subject of paved roads we would particularly call the attention of our readers to the results of Mr. Walker's experiments in the Commercial Road, as we are informed that the London and Holyhead Steam-Coach and Road Company intend laying down the road in a similar manner; this system, therefore, becomes the more interesting; and, we conceive, will be the means of placing the present roads in a state capable of competing with the best formed rail-roads, owing to the capital which will be required for this purpose, being but a fraction of that which is required for a new line of road for railways, and will sustain the road-side property at least to its present value.

"* This has been the regular charge on the Ellesmere Canal for some years, and is now introduced on the Oxford canals, and several others."

"In situations where canals cannot be constructed, either from want of water, or other circumstances, and where the description and quantity of traffic, or local obstructions, do not justify the expense of forming a rail-road, paved roads made on proper principles would be found much mutter for conveying goods than turnpike roads, constructed as they usually are. The advantages which may be derived from paved roads, as a means of transport, have been too much overlooked; and therefore it is very important to show how much superior a well made paved road is to a common road in enabling horses to draw very large burdens.

"On a smooth, well made pavement, quite horizontal, it appears, from the experiments made with Mr. Macneill's machine, that the resistance to draught is not more than the 100th part of the weight of the carriage and its load, when the carriage is properly constructed, and mounted on straight and cylindrical axles.* According to this a horse of great power would be able to draw on such a road, if horizontal, six tons and three quarters; and if with no greater inclination than 1 in 50, two tons and a quarter.

"The plan of paving this road was altered in 1829: large blocks of granite, five or six feet in length, sixteen inches wide, and twelve inches deep, were laid for the wheels to run upon, as on a tram-road of iron, except that there is no flanche. The space between the granite blocks is paved. The plan has succeeded, as may be seen from the following report of Mr. Walker to the trustees of this road:—

"'I beg to report the results of the experiments made this day upon the stone tramway now forming on the Commercial Road, before you, accompanied by the chairman of the West India Dock Company, and Mr. Colville, one of the directors.

"'The experiments were made upon the space between the West India Dock-gate, and the first turnpike upon the Commercial Road, with a very good town-made waggon, belonging to Messrs. Smith and Sons, distillers, and a stone truck, belonging to Messrs. Freeman.

"'The dust had been swept off the tramway in the morning. The distance is 550 feet, of which 250 feet nearest the dock-gate rises 1 foot, or one in 250, and the other 300 feet rises about 2½ feet, or 1 in 116.

"'The whole rise in the 500 feet is 3½ feet, or 1 in 155.

"'The gravity of one ton upon the lower length is, therefore, 2240 lbs. divided by 250, or nearly 9 lbs. Upon the upper length it is 2240 lbs. divided by 116, or 19½ lbs., and the average of gravity upon the whole length is 2240 divided by 155, or 14½ lbs.

"'Experiment 1st. The general average resistance of four tons

"* See Seventh Report on the Holyhead Road."

gross (viz. waggon 1 ton 16 cwt., and goods 2 tons 4 cwt.), as ascertained by your chairman (C. H. Turner, Esq.) and Mr. Colville, by means of a spring weighing machine, was 127 lbs.; from which, if we deduct the gravity of 4 tons, or 19½ lbs. multiplied by 4, say 77 lbs., there is left, for the friction of 4 tons, 50 lbs., which gives for the friction of 1 ton 12½ lbs., $\frac{1}{180}$th of the whole weight moved.

"'This friction is not more than upon the best constructed edge railway. I consider that the greater size of our wheels, and there being no flanche, compensate for the roughness of the stones (from their being newly laid), as compared with an iron railway.

"'Experiment 2d. A pony 12½ hands high, weight 4½ cwt., drew upon the upper part in your presence, and afterwards upon the lower part in your and the director's presence, six tons (gross). I was not aware that the difference of inclination of the two parts was so great, or he should have gone over the upper length again,—he had done it more than once before.

"'Taking, therefore, the upper part on the rise of 1 in 116, the pony's exertion was,

	lbs.
"'Gravity 19½ lbs. multiplied by 6, or.... ...	116
Friction 12½ lbs. multiplied by 6, or........	75
Making together........	191

and 191 lbs. divided by 12½ lbs. (the friction of one ton) gives 15 tons.

"'The pony's work, therefore, was equal to *fifteen tons* drawn upon a level road.

"'Experiment 3d. The waggon, loaded as in the preceding experiment, being turned round and started by the pony's exertion, ran down the whole length to the dock-gate with increasing velocity (the pony not drawing it), and for a distance off the tramway, before it could be stopped: consequently, the average fall of 1 in 155 exceeded the resistance by friction.

"'Experiment 4th. A powerful horse (weight 14 cwt.) drew 12 tons gross (the waggon and truck loaded) from the West India Dock-gate to the turnpike, at the rate of 4 miles per hour.

"'Taking then, the upper length, or a rise of 1 in 116, we have

	lbs.
Gravity 12 times 19½ lbs., or......	232
Friction 12 times 12½ lbs., or......	150
Making together....	382

and 382 lbs. divided by 12½ lbs. gives 30½ tons.

"'The horse's work was therefore the same as if he had been drawing 30½ tons upon the level.

"'The full average work of a horse, per day, is 150 lbs. moved 20 miles; consequently the pony was exerting one-fourth more than the average work of one horse through the day; and the horse was doing the work of 2½ horses.

"'The horse appeared to go easily; but the exertion was, of course, too great to be continued for any considerable time, so as to form a basis for general calculation.

"'Upon the whole, I think the conclusion is, that if the road were level, the work of a London draught horse upon the tramway would be ten tons (gross); but as the Commercial Road rises towards London, a deduction must be made from this for gravity, the amount of which depends upon the inclination of the road, and is common to all kinds of roads and railways. Therefore, taking all things into consideration, I am of opinion that six tons (gross) from the Docks to Whitechapel, and a greater weight from Whitechapel to the Docks, may be considered a proper load for one horse on the tramway.'"

The ordinary street paving is next treated of, where the system of making a good and positively hard foundation is recommended, with detailed accounts of various means of obtaining such foundation. Amongst others, it is suggested, that broken granite should be laid down in successive layers, each layer being well beaten down by the passage of horses and carriages; by this means a suitable bearing will be prepared for the paving stones, which will not be liable to sink unequally. The present state of Blackfriars' Bridge may be given as the result of such a course. The bridge having been what is called Macadamised for some length of time, that system not succeeding, became an excellent foundation for the present paving stones. The author very properly points out the erroneous plan proceeded on in Fleet Street, where large quantities of broken granite were first laid over the road, without being subjected to any beating or pressure; consequently, the paving stones have, in a very short time, become nearly as unequal as if the broken granite had not been first laid on;—thus has an enormous expense been gone to without an adequate result. The author shews very clearly, that whatever description of surface the road is intended to have, the most material point to

be attended to, is, the obtaining of a perfectly hard foundation. By pursuing this system, a carriage passing over a road, will have less resistance than when a road with a similar surface has an elastic foundation; in this we fully concur; and we may mention, as a proof of this position, that a ball on a billiard table of cast-iron, such as are now made at Manchester, will require less force to obtain a particular result, than when the table is of wood, although they are both similarly covered with green cloth: this is so evident to a player, that, on first attempting to play on a cast-iron table, each stroke made he finds too strong, till, by practice, he becomes acquainted with the degree of force required.

The work next treats of fences, bridges, walls, drains, toll-houses, and gates, with accounts of the instruments and tools to be used. The last chapter is on road legislation, and is by no means the least important. We cannot close our remarks without again recommending this valuable volume to all who are interested in road making, and we conceive this will apply to every one who is desirous of advancing the wealth of England; for it must be generally allowed, that every improvement in the means of effecting internal communication, must be considered most important to a nation where manufactures and agriculture are carried to the greatest possible extent.

Statistics of France. By Lewis Goldsmith: Hatchard and Son, London.

The extensive opportunities which the author has had of obtaining the most correct information on the various branches of the Statistics of France must render the present volume a desirable acquisition. There are but few parts which fall within the scope of our work; we must, therefore, content ourselves with giving an extract, which relates to manufactures:—

"The principal manufactures of France may be dated from the reign of Louis XIV., whose minister, the celebrated Colbert, invited foreign artists and artisans of every kind and of distinguished merit into the kingdom, and encouraged them by premiums to fix their establishments in France. But towards the end of his reign, that monarch, by his revocation of the Edict of Nantes, and his persecution of the Protestants, in a great measure destroyed the advantages arising from the foreign establishments, by forcing thousands of artisans to seek refuge in England and the Low Countries, into which they introduced those branches of industry, especially silk. Thus France lost the services of some of her most ingenious mechanics through the folly of an infatuated monarch.

"To give an idea of the manufactories of France, it is sufficient to cite the draperies of Louviers, Sedan, Elbeuf, Castres; the cambrics of Valenciennes and Cambray; the pier-glasses of St. Gobain, whose dimensions are occasionally ten feet in height by four and five feet broad; the cotton manufactories of St. Quentin, Rouen, &c. &c.; the linens of Brittany, Dauphiny, and the northern provinces; the laces of Lille, Alençon, Valenciennes, and Puy; the silks of Lyons, Avignon, Nîmes, and Tours; the tapestries of the Gobelins, at Paris; the carpets of La Savonnerie and Aubusson, which, in beauty of design and brilliancy of colours, rival those of the east; the porcelain of Sevres her manufactories of clocks and watches, jewellery, crystal, mock diamonds, bronzes, fire-arms, &c. To these might be added an immense number of manufactories which were wholly unknown in France half a century ago, such as files, needles, wool-cards, &c.

"We have learned from official sources, that the capital employed in manufactures amounts to 1,820,105,409 fr., which is applied as follows:—

In indigenous materials	416,000,000 fr.
In materials imported	186,000,000
In wages	844,000,000
In general expenses, as wear and tear of machinery and tools, repairs, fuel, lights, interest of money invested as fixed capital, which being deducted from the gross amount, leaves 182,105,409 fr. for the profit of the manufacturers	192,000,000

"The annual produce of the principal branches of industry in 1828 has been calculated in round numbers as follows—

Thrown silks, silk stuffs, gauzes and crapes	160,000,000 fr.
Cloths and woollen stuffs	250,000,000
Carried up......	410,000,000

Brought up......	410,000,003 fr.
Linen drapery and thread lace	210,000,000
Stationary	25,000,000
Cotton	200,000,000
Lace	10,000,000
Hardware	125,000,000
Coal and other produce of mines and quarries	30,000,000
Watches and clocks	30,000,000
Gold and Silver articles	50,000,000
Jewellery	40,000,000
Glass, plate glass, china, pottery, bricks	80,000,000
Lime and plaster	15,000,000
Salts and acids	30,000,000
Soap	30,000,000
Refined Sugar	15,000,000
Hats	30,000,000
Leather	160,000,000
Dye and varnish	50,000,000
Perfumery	15,000,000
Books	30,000,000
Beer	60,000,000
Cider and perry	50,000,000
Brandy	75,000,000
Upholstery and musical instruments	50,000,000
Total....	1,820,000,000 fr.

"Having enumerated the principal manufactures in France, we shall state from official information the progress made in the productions of those manufactories from 1812 to 1827. In the first place, we find that under the government of the empire, when Belgium and the left bank of the Rhine were under her dominion, France in 1812 employed in her manufactories 35 millions kilogrammes, or 70 million lbs. of native wool. In 1816, the quantity of native wool, with the amount imported of foreign wool for fine cloths, merinos, and cachemires, &c., was in the whole 80 million French pounds, which, with the difference of nearly ten per cent., is equal to 90 million lbs. English. In 1824 and 1826, the quantity of wool used in the manufactories amounted to 48 millions of kilogrammes, making an increase in the consumption of wool, in fourteen years, of 26 millions of French pounds, or more than one million English tod.

"In 1812, the quantity of cotton spun into thread did not exceed 10,362,000 kilogrammes. The consumption in 1816 amounted to 12 millions of kilogrammes; in 1825, the quantity manufactured was 26 millions; in 1826, 32 million kilogrammes of cotton employed in

prints, calicoes, tulles, &c.: thus the consumption has been more than tripled in fourteen years. The consumption of silk has not less increased, in proportion to wool and cotton. In 1816, France imported 400,000 kilogrammes of silk; in 1824 and 1825, 650,000 kilogrammes; and in 1826, not less than 800,000 kilogrammes, notwithstanding the progress made and encouragement given to breeding of silk-worms in the country. In 1816, the quantity of coals extracted from the mines did not exceed 1000 million kilogrammes; in 1826, they furnished 1500 million kilogrammes. In 1814 and 1816, the quantity of iron manufactured amounted to 100 millions, and in 1825 and 1826, it had increased to 160 millions of kilogrammes."

VARIETIES.

Institution of Civil Engineers.—At a meeting on January 21st, the following were elected officers. *President*, Thomas Telford, Esq. *Vice-Presidents*, J. Walker, Esq., J. Field, Esq., H. R. Palmer, Esq., W. Cubitt, Esq. *Council*, B. Donkin, Esq., R. Sibley, Esq., J. Simpson, Esq., S. Clegg, Esq., W. Brunton, Esq., J. Macneill, Esq., J. Farey, Esq. *Auditors*, E. Turrell, Esq., A. H. Renton, Esq. *Treasurer*, W. A. Hankey, Esq. *Secretary and Collector*, Mr. G. C. Gibbon.

Royal Institution—The weekly evening meetings commenced for the season on Friday, the 24th Jan.; and on Saturday, the 25th, Prof. Brande commenced a course of Lectures, to be continued every succeeding Saturday till Easter, "On the Elementary Doctrines of Chemical Philosophy, and their application to Arts and Manufactures." On Tuesday, the 28th January, Professor Ritchie commenced a course of Lectures, to be continued every succeeding Tuesday till Easter, "On Light and Optics." And on Thursday, the 30th, Mr. Webster gave a Lecture on "Geology," to be continued every Thursday till Easter. After Easter, Dr. Lardner will deliver three Lectures "On the Principle, Structure, and Operation of Babbage's Machinery for Calculating and Printing Numerical Tables." The same gentleman will also deliver a course of Lectures "On the Progressive Growth of the Steam Engine," which will embrace the subject of railways, turnpike roads, canals, and river navigation. Mr. E. Grant will give a course of eight Lectures "On the Invertebrated or Lowest Classes of Animals, from Animalcules up to Fishes." And Professor Brande will conclude the course, now in progress, "On the Elementary Doctrines of Chemical Philosophy," mentioned before. Dr. Faraday will also give a course, but the subject is not yet announced.

NOTICE OF EXPIRED PATENTS.

George Shoobridge, of Houndsditch, London, Woollen Draper, and William Shoobridge, of Mardon, Kent, Farmer, for a substitute for flax or hemp, and for manufacturing the same for all purposes for which flax or hemp are used.—Sealed February 5, 1820.—(*For copy of specification see Repertory, Vol.* 40, *second series, p.* 11.)

James Huggett, of Hailsham, Sussex, Shoeing-Smith, for a machine to be attached to carriages as a substitute for a drag, to regulate the speed, and to prevent accidents in going down hill, or in other perilous situations.—Sealed February 10, 1820.—(*For copy of specification see Repertory, Vol.* 40, *second series, p.* 65.)

LIST OF NEW PATENTS.

Thomas Sharp, of Manchester, in the County Palatine of Lancaster, and Richard Roberts, of the same place, Engineers, for certain improvements in machinery for grinding corn and other materials. Communicated by a foreigner residing abroad.—Sealed January 1, 1834.—(*Six months.*)

Joshua Taylor Beale, of No. 11, Church Lane, Whitechapel, in the County of Middlesex, Engineer, for a lamp applicable to the burning of substances not hitherto usually burned in such vessels or apparatuses.—Sealed January 4, 1834.—(*Six months.*)

Frederick Plant, of Bread Street Hill, in the City of London, Fur-Cutter, for an improved fur-cutting machine.—Sealed January 13, 1834.—(*Two months.*)

Pennock Tigar, of Grovehill, in the Parish of St. Nicholas, in the Liberties of Beverley, in the County of York, Merchant, for certain improvements in the construction and arrangement of iron or other metal wheels for carriages.—Sealed January 13, 1834.—(*Two months.*)

Joshua Bates, of Bishopsgate Street, in the City of London, Merchant, for an improved method of condensing æriform substances and refrigerating fluids. Communicated by a foreigner residing abroad.—Sealed January 13, 1834.—(*Six months.*)

James Walton, of Sowerby Bridge, in the County of York, Cloth-Dresser, for improvements in machinery for facilitating the operations of raising, dressing, and cropping the pile of woollen and some other fabrics.—Sealed January 14, 1834.—(*Four months.*)

Charles Attwood, of Whickham, near Gateshead, in the County of Durham, Manufacturer of Soda, for the art of making a certain pigment or certain pigments by a certain process or certain processes not previously used for such purpose or purposes.—Sealed January 16, 1834. (*Six months.*)

James Boynton, of High Holborn, in the County of Middlesex, Portable Ink Stand Manufacturer, for improvements in apparatus or means of producing light.—Sealed January 18, 1834.—(*Six months.*)

William Morgan, of Penton Row, Walworth, in the County of Surrey, Plumber and Glazier, for an apparatus for heating and ventilating churches, conservatories, houses, and other buildings or places.—Sealed January 18, 1834.—(*Six months.*)

Jean Jacques Leopold Oberlin, of Leicester Square, in the County of Middlesex, Merchant, for improvements on, or additions to, boilers applicable to various purposes. Communicated by a foreigner residing abroad.—Sealed January 18, 1834.—(*Six months.*)

Ernst Wolff, late of Leeds, in the County of York, but now of Stamford Hill, in the county of Middlesex, Gentleman, for certain improved means of supplying heated air in order to support combustion in enclosed fire-places. Communicated by a foreigner residing abroad. —Sealed January 23, 1834.—(*Six months.*)

THE

REPERTORY

OF

PATENT INVENTIONS.

No. III. NEW SERIES.—MARCH, 1834.

Specification of the Patent granted to GEORGE FREEMAN, *of Tewkesbury, in the County of Gloucester, Lace Manufacturer, for Improvements in Machinery for Ornamenting and producing Devices upon Lace-Net.* —Sealed February 22, 1832.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.— *Now know ye*, that in compliance with the said proviso, I, the said George Freeman, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawings hereunto annexed, and to the figures and letters marked thereon (that is to say):—

My invention consists in obtaining certain movements to an ordinary traverse warp-machine, by certain additions thereto, whereby I am enabled, by separating certain of the warp-threads in a traverse warp-machine (in making what is called bobbin-net quillings), to cause the machine to work in such manner, that such warp-threads are

alternately caused to act as spotting-threads, and then to work as the common warp-threads for making the plain part of the lace; by which means the lace thus produced has a better finish, and the operation of cutting the parts of the spotting-threads from spot to spot, as is the present practice, is rendered unnecessary; in addition to which, the number of threads, according to my improvements, for making a given width of lace, is lessened by the number of threads heretofore used for spotting-threads.—Supposing the width of the intended lace was to consist of one hundred warp-threads, and it was desired to have a spot to every fifth thread, there would then be twenty additional threads on separate spools or bobbins, making in the whole one hundred and twenty threads (according to the old plan); these spotting-threads are passed through guides in the spotting-bars, as is well understood by lace makers; but these spotting-threads are only brought into action at the times when it is desired to make the spots, at other times they are not, being worked into the lace; but the plain lace is formed by the warp-threads only, consequently the threads from spot to spot require to be cut off, otherwise there would be a thread shewing from spot to spot, which would hang loose. But by my improvements for making a similar width of lace, the additional spotting-threads are dispensed with, and a like number of threads are taken from the warp, which, as before observed, act both as spotting-threads and warp-threads.

The traverse warp-machine being well understood, and as it only requires a very slight alteration by the addition of certain wheels for giving certain additional motions to the ordinary spotting-bars, it will not be necessary to describe the machine itself; but I will confine myself to the description of such additions, and the motions produced, referring generally to the manner of working the machinery so as to produce the object of my invention.

In order that my invention may be fully described and ascertained, I will proceed to describe the means I pursue in order to obtain the objects of my invention. I will suppose myself placed in front of an ordinary traverse warp-machine, which is fitted up with spotting-bars, as if it were intended to make spotted lace according to the old means above mentioned. To this machine I apply certain wheels which are represented in the drawings as follows:

Description of the Drawing.

On to the dividing bar is affixed an axle or spindle of the spotting-wheels, and these move together with the dividing bar, as will be fully described hereafter: the axle of the spotting-wheels is about three inches long, and is affixed near the right-hand end of the dividing bar, as is the case with the axle which was formerly used for the wheel heretofore employed for dividing the spotting-bars. On this axle is placed five wheels No. 1, No. 2, No. 3, No. 4, and No. 5, in the drawings, and the wheels are kept apart about three-quarters of an inch, by washers placed on the axle between the wheels; and when the wheels are placed on the axle, there are two screws passed through the holes *a, a,* and the whole are securely held together. The wheel No. 1, which I call the bottom driving or ratchet-wheel, having ten teeth, is first placed on the axle on the dividing bar, then a washer above described, then the wheel No. 2, which is a spotting-wheel, and acts upon the front spotting-bar. This spotting-wheel has seven rises and seven falls, each rise and each fall (with the exception of one fall at finishing of the spot) is equal to one twenty-fourth part of an inch in height and depth, which is equal to one space in the dividers; and the one fall at the finishing the spot, is equal to one-twelfth part of an inch, which is equal to two spaces in the dividers (this is in a twelve-point machine). The wheel No. 3, is also a spotting-wheel, and acts

against the back spotting-bar, and which wheel has eight rises and eight falls, each rise and each fall (with the exception of one fall at finishing of the spot) is equal to one twenty-fourth part of an inch, which is equal to one space in the dividers; and the one fall at the finishing of the spot, is equal to one-twelfth part of an inch, which is equal to two spaces in the dividers. The wheel No. 4, is a driving or ratchet wheel with two teeth, one tooth on each side opposite each other. The wheel No. 5, or top wheel, is also a driving or ratchet wheel with twelve teeth in it. What is meant by driving wheels, are those wheels which are actuated by drivers from the machinery, as hereafter described, and their being driven round, cause the spotting-wheels to turn, and thus give the requisite movements to the spotting-bars, as will be fully described hereafter. The driver which drives the top driving-wheel is about twelve inches long, and is connected to one end of a lever, which is suspended from a fulcrum from the top cross-bar at the end of the machine; and to the other end of the lever is connected an iron rod, which descends down towards the floor, and is connected at bottom to a piece of iron, which acts as a treadle, it moving on a joint at one end, and is occasionally depressed by the tooth of a wheel hereafter mentioned, by which the iron rod is brought down, and with it that end of the lever to which it is connected; and thus the lever elevates the driver of the top driving-wheel one tooth each time the rod is acted on, if there be a tooth in the way of the driver, otherwise it makes a motionless move. The wheel which actuates the iron rod before described, is affixed on the shaft which is usually under the machine, and gives motion to certain other parts of the machinery, as is well understood: the wheel contains three ratchet-teeth, for driving out the points, as is usual, and six teeth or pins on one side, which move the driver, at the proper periods, by the six pins successively actuating on the driver of the top driving-wheel. The middle driver is about twelve inches

long, and is similarly affixed to that last described, and as close to the top driver as possible; but in place of the iron rod which actuates this driver, being actuated by the wheel on the shaft of the machine, the piece of iron which acts as a treadle is actuated by its being connected to the front and back joint cross-bars, and is actuated by their movement which raise up the part which acts as a treadle about one inch each move, and thus drives the spotting-wheels one tooth at each movement, when there is a tooth on this driving-wheel to be acted on by the driver, otherwise the driver makes a movement without driving the spotting-wheels. The driver to the bottom wheel is about six inches long, and is affixed on an axle connected to the joining machine; and when the cross is affected, the joining machine is moved forward and drives the spotting-wheel one tooth. There being twenty-four teeth in the three driving wheels, they will thus be caused to make one turn by twenty-four effective movements of the drivers, and will thus cause the spotting-wheels to make one revolution.

The dividing points are about five inches long, and are formed very small at the outer ends, for about an inch, as a divider; the other ends are screwed on to a bar about three-quarters of an inch square, which bar is fixed in a machine similarly constructed to the fork-bars, is fixed similarly to the joining machine, and over and as close to the back cross-bar as possible: the dividing points move forward between the warp-threads, and project forwards in front thereof, about half an inch, close to the dividers, and one point between each breadth, to prevent the outside spotting-threads, when they come to the selvage, from crossing over into the adjoining breadth. These dividing points are only required to come and remain forward when the spots are being made, but must go behind the warp-threads when the cross is made; and they are taken back by the back of the cross-bar of the joining machine bearing against a lever connected with the ma-

chine, which carries the dividing points, and a catch takes hold and retains them back; and then when the pin machines are worked up, they strike a lever, and the catch being connected by a rod, and just as the pins enter the cross, they lift up the catch and let the dividing points come forward and pass between the threads at the selvages.

Those threads which are intended to act as spotting-threads, in place of being wound on the warp-beam, are placed on separate bobbins or beams. I use four separate bobbins, two large and two smaller ones; on to the two larger ones those threads that are in the middle of a breadth for forming the spots, whilst the two outer spotting-threads which are next the selvages of each breadth of lace, are put on the smaller bobbins, by which arrangement I am enabled, by means of the dividing points, to prevent such outer spotting-threads (when they have spotted, and work out to the selvages) passing into the next breadth; but such threads work into the selvages at the time the other spotting-threads are making spots. The bobbins on which the spotting-threads are wound, work on an axle about three feet above the spotting-bars, at a convenient distance from each other. On each of these bobbins there is formed a warve or pulley for a friction cord, which has a weight suspended for keeping the threads at a proper tightness; but as it is desirable to relieve such threads at the time of making the spots, in order to produce spots with loose threads, otherwise such spots would be drawn tight, and much too close, but by lifting the weights, the threads will be worked into spots whilst loose, and thus allows the spots to spread out and form themselves properly. In order to produce this lifting of the weights which act on those of the warp-threads, which are passed through the guides in the ordinary spotting-bars, and which act as spotting-threads as well as warp threads—about one foot above the right-hand end of the machine, on bearings, I place an axle, having affixed thereon

two wheels, the one a driving or ratchet-wheel, the other an eccentric, as shewn in Nos. 6 and 7; the driving or ratchet-wheel No. 7, has ten teeth, and the eccentric No. 6 (having one rise and one fall), is connected with No. 7, on the same axle, and comes in contact with one end of a lever which lifts the weight. The lever is suspended under the weights which it has to raise, one end of the lever being broad or spoon-like, to receive the weight, and the other end is acted on and depressed by the revolution of the wheel No. 7, and thereby raises the weight: these parts are intended for the weight which acts on the bobbins which contain those of the threads, which are the two outer ones of each breadth.

The driver which drives the wheel No. 6, is connected to the joining machine, and drives that wheel one tooth every time a cross, or finishing the hole, is effected. The bobbins which contain the other of the spotting-threads being similarly acted on by other similar parts.

Nos. 8 and 9, represent another driving or ratchet-wheel, having ten teeth; and also another eccentric having two rises and two falls which act on a lever for raising the weight which presses on the bobbins which contain the other of the spotting-threads; the axle of these is placed in bearings on the left-hand end of the machine, about one foot above the top of the machine, the driving or ratchet-wheel having ten teeth, which is actuated by a driver which is attached to the joining machine, and drives the driving ratchet-wheel No. 8, one tooth each motion thereof, or at the time the cross, or finishing of the hole, is effected. The lever which raises the weight of these bobbins or beam is affixed under such weight; and the lever is depressed, and raises the weight at each motion, as described.

Having now described the various parts of the alterations which are to be made in an ordinary traverse warp-machine, in order to obtain the necessary motion to the spotting-bars, I will now proceed to describe the manner

of working the machine in order to obtain the description of net above mentioned, that is, lace or net having spots therein.

Take every fifth thread out of the warp, and in place of putting them on the warp-beam, they are to be put on the separate bobbins or beams, as before described; these threads I pass through the guides in the spotting-bars, similarly to the old plan for spotting-threads, as heretofore has been practised, an equal number being placed through the guides in each spotting-bar, and make the threads fast to the lace-beam or roller. The workman will let the wheels No. 6 and 7, 8 and 9, be turned for the hills or risings No. 7 and 9, at each end of the machine, to bear on the levers to lighten the spotting-threads, and will begin to spot with the carriages in the back comb-bar, bring the dividing points forward in between the selvage threads, move the back-comb-bar up to make the first twist; and when the carriages have entered the threads, the top driver moves the driving-wheel No. 5, and thus moves the spotting-wheels Nos. 2 and 3, one tooth, which drives the back spotting-bar one space to the left by the spotting-wheel No. 3, and causes the threads therein to stand behind the front spotting-threads which are in the front spotting-bar, and thus enable the carriages to work round them the second twist to begin to form the spot. Then move the front-comb-bar up to make the second twist; and when the carriages have entered the threads, the top driver moves the spotting-wheels Nos. 2 and 3, one tooth, which drives both spotting-bars one space to the right, to put the threads in a right position for the third twist, that is, with one row of the spotting-threads, or the contents of one of the spotting-bars standing directly opposite or in front of the other spotting-threads of the other spotting-bar; and when the two sets of spotting-threads are thus opposite each other, they are passed by the same carriages: then move the back-comb-bar up to make the third twist. In making

this third twist the spotting-threads stand opposite the same spaces in the dividers as they did when the second twist was finished, the top driver moves the spotting-wheels one tooth, but there being no rise or fall thereon, the spotting-bars are not acted on, and remained unmoved by the spotting-wheels. The workman is next to make the cross or top of the holes or meshes by moving the joining or crossing machine forward, which will take the dividing points back behind the warp-threads, and turn the spotting-bars on their axes, to keep the spotting-threads out of the forks, as they come forward, to make the cross and the bottom driver by the motion of the joining machine, move the spotting-wheels one tooth, which drives the first spotting-bar one space to the left. The back pin machine is then put up, which lifts the catch, and lets the dividing points come forward and pass between the selvage threads; one half of the spot is now made, and the back pins have taken them down. Then move the back (empty) comb-bar up, and the second driver moves the spotting-wheels one tooth, which moves the back spotting-bar one space to the left, which causes the back spotting-threads to stand directly at the back of the front spotting-threads for the carriages to work round them, the first twist in this half hole, move the front comb-bar up; and when the carriages have entered the threads, the top driver moves the spotting-wheels Nos. 2 and 3, one tooth of the driving-wheel, which drives both spotting-bars to the right, to put the spotting-threads in the right position for the second twist, the spotting-threads in one spotting-bar standing in front and opposite to the threads in the other spotting-bar, move the back-comb-bar up, and when the carriages have entered the threads, the top driver moves the driving-wheel; but there being no rise or fall, the spotting-bars are not acted on, and remain unmoved by the spotting-wheels. Move the front-comb-bar up, and when the carriages have entered the threads, the top driver moves the driving-wheel

one tooth; but there being no rise or fall, the spotting-bars are not acted on, and remain unmoved by the spotting-wheels. The spot being now finished, make the cross or top of the hole by moving the joining machine forward, which takes the dividing points back behind the warp-threads, as before described; and the bottom driver moves the bottom driving-wheel one tooth, which drives the front-spotting-bar two spaces to the left, by means of the spotting-wheels No. 2 and No. 3, the back spotting-bar one space to the right, and turns the spotting-bars on their axis, to keep the spotting-threads out of the way of the forks as they come forward, and moves the wheels Nos. 6 and 8, one tooth, and removes the hill that bears up the levers, and thus allow the weights to have their full power on the spotting-threads while they are being worked into the net. Put up the front pin machine to take down the cross, and the row of spots which will lift up the catch, and let the dividing points come forward and pass between the selvages, as before described.

One row of spots being finished, the spotting-threads traverse in opposite directions while being worked into the net, the front bar to the left and the back bar to the right. In making the plain net, each spotting-thread stands opposite each vacant space in the dividers, from which every fifth thread has been taken for spotting-threads; and then these threads are acting as warp-threads, and they traverse opposite those vacant spaces until the commencement of the next spot. Make three twists as usual, then the cross or top of the hole, by the joining machine moving forward, the dividing points are taken back behind the warp-threads, the catch holds them, the bottom driver moves the driving-wheels one tooth, which drives (by means of the spotting-wheels Nos. 2 and 3) the front-spotting-bar one space to the left, and the back-spotting-bar one space to the right. Put up the pin machine, which lifts up the catch and lets the dividing points come forward and pass between the selvage

threads. Make three twists for the second half hole; then move the joining machine forward to make the cross, which takes the dividing points back behind the warp-threads, the catch holds them. The bottom driver moves the driving-wheel one tooth, which drives the front spotting-bar one space to the left, by the spotting-wheels Nos. 2 and 3, and the back spotting-bar one space to the right. Put up the pin machine, which lifts up the catch, and lets the dividing points come forward and pass between the selvage threads. Make three twists for the third half hole, then move the joining machine forward to make the cross, which takes the dividing points back behind the warp-threads, and the catch holds them. The bottom driver moves the driving-wheel one tooth, which, by means of the spotting-wheels Nos. 2 and 3, drives the front spotting-bar one space to the left, and the back spotting-bar one space to the right: here the spotting-wheels have worked one half the way round. The two spotting-bars have now traversed until they have caused a back and front thread to come opposite to each other, and put them in a proper state to commence making another row of spots. Note.—At the commencement of making the first row of spots, the first thread in each bar at the right-hand side work together to form the spots.

In beginning the second row of spots, the first thread in the front bar, and the second thread in the back bar work together to form the spot. Now begin with the carriages in the front-comb-bar, the dividing points to be forward in between the selvage threads, and the wheels Nos. 7 and 9, will be so placed, that the hills bear up the levers to lift up the weights and lighten the spotting-threads. Move the front-comb-bar up, and when the carriages have entered the threads, the top driver moves its driving-wheel one tooth, which drives the back spotting-bar one space to the right, by the spotting-wheel No. 3, which causes those threads to stand directly behind the front spotting-threads, to enable the carriages to work round

them in making the second twist, to begin to form the spot. Move the back-comb-bar up to make the second twist; and when the carriages have entered the threads, the top driver moves its driving-wheel one tooth, which, by means of the spotting-wheels 2 and 3, drive both spotting-bars one space to the left, to put the threads in a right position for the third twist, one row of spotting-threads standing in front of the other row. Move the front-comb-bar up to make the third twist; in making this twist the spotting-threads stand opposite the same spaces in the dividers as they did when the second twist was finished, the top driver moves its driving-wheel one tooth; but there being no rise or fall, the spotting-bars are not acted on, and remain unmoved by the spotting-wheels. Make the cross or top of the hole by moving the joining machine forwards, which takes the dividing points back behind the warp-threads, and turns the spotting-bars on their axes, to keep the spotting-threads out of forks as they come forward, to make the cross, and the bottom driver moves the bottom driving-wheel one tooth, which, by the spotting-wheel No. 2, drives the front spotting-bar one space to the right. Put up the front pin machine, which lifts up the catch and lets the dividing points come forward and pass between the selvage threads. One half of the spot is now made, and the front pins have taken it down. Move the front empty comb-bar up, and the second driver moves its driving-wheel one tooth, which, by the spotting-wheel No. 3, moves the back spotting-bar one space to the right. The back spotting-threads now stand directly behind the front ones, for the carriages to work round them the first twist in this half hole. Move the back-comb-bar up, and when the carriages have entered the threads, the top driver moves its driving-wheel one tooth, which, by the spotting-wheels Nos. 2 and 3, drives both the spotting-bars to the left.

To put the spotting-threads in a right position for the

second twist, one row of spotting-threads standing in front of the other. Move the front-comb-bar up, and when the carriages have entered the threads, the top driver moves its driving-wheel one tooth; but there being no rise or fall, the spotting-bars are not acted on, and remain unmoved by the spotting-wheels. Move the back-comb-bar up; and when the carriages have entered the threads, the top driver moves its driving-wheel one tooth; but, as before observed, the spotting-bars remain unmoved by the spotting-wheels. The spot being finished, make the cross or top of the hole by moving the joining machine forward, which takes the dividing points back behind the warp-threads, and the bottom driver moves the bottom driving-wheel one tooth, which, by the spotting-wheels Nos. 2 and 3, drives the front spotting-bar two spaces to the right, and the back spotting-bar one space to the left, and turns the spotting-bars on their axes to keep the spotting-threads out of the way of the forks, as they come forward, and the wheels Nos. 6 and 8, are moved one tooth, for the hills to bear up the levers, and allow the weights to have their full power on the spotting-threads, whilst they are being worked into the net. Put up the back pin machine to take down the cross and the row of spots; this lifts up the catch and lets the dividing points come forward and pass between the selvage threads. The second row of spots being finished, the spotting-threads traverse in opposite directions whilst being worked into the net between the rows of spots, the front bar to the left, and the back bar to the right. Make three twists, then the cross or top of the hole, by the joining machine moving forward, the dividing points are taken back behind the warp-threads and the catch holds them, the bottom driver moves its driving-wheel one tooth, which, by the spotting-wheels Nos. 2 and 3, drives the front spotting-bar one space to the left, and the back spotting-bar one space to the right. Put up the pin machine which lifts up the catch and lets the dividing points come for-

ward and pass between the selvage threads, a second half hole is performed, after finishing the spot, by making three twists; then the cross or top of the hole is formed by moving the joining machine forward, which takes back the dividing points behind the warp-threads, and the catch holds them; the bottom driver moves the bottom driver-wheel one tooth, which drives the front spotting-bar one space to the left, and the back spotting-bar one space to the right, by the spotting-wheels Nos. 2 and 3. Put up the pin machine, which lifts up the catch, and lets the dividing points come forward and pass between the selvage threads. A third half hole is performed by making three twists, then the cross or top of the hole, by moving the joining machine forward, which takes back the dividing points behind the warp-threads, and the catch holds them. The bottom driver moves the driving-wheel one tooth, which drives the front spotting-bar one space to the left, and the back spotting-bar one space to the right, by the spotting-wheels Nos. 2 and 3. The wheels Nos. 7 and 9, now bear on the levers, and lift up the weights, to lighten the spotting-threads. Put up the front pin machine, which lifts up the catch, and lets the dividing points come forward and pass between the selvage threads. This completes two rows of spots, and the net between the rows; the spotting-wheels have been worked round once; the wheels and tackle now stand in the same position as at the commencement of the first spot, and is now in a right position to commence the third spot, with the carriages in the back-comb-bar.

Having now described the manner of working the machinery according to my invention, it will be evident that, although I have here described the spots as being made at every fifth thread, that the same may be done at a lesser or larger number of threads, if required. But in order to obtain this, the spotting-wheels and the driving-wheels would have to be formed accordingly. And, in order to give some rule to proceed upon, when it is wished to alter

the number of spots, the parts of the wheels Nos. 2 and 3, called spotting-wheels, which move the spotting-bars when the spots are being made, must not be altered, as the same motions are required to the spotting-bars for making the spots in all numbers; but those parts of the wheels No. 2 and 3, which cause the spotting-bars to traverse for keeping the spotting-threads opposite the spaces in the warp (from which they have been taken). These parts of the wheels Nos. 2 and 3, have to be changed according to the number of warp-threads between the spotting-threads: thus, for instance, were it desired to make lace, taking every tenth thread (in place of every fifth) for a spotting-thread, it would then be necessary to have as many more rises and falls, that is, twice as many when every tenth thread is used (as there would be for every fifth thread), for causing the spotting-bars to traverse for keeping the spotting-threads to stand in front of the spaces from which they have been taken from the warp for making the plain net. From this it will be readily understood, how any number of spots may be made in a breadth; and it will only be desirable further to add, that it is necessary, in settling on the number of threads which are to act as spotting-threads as well as warp-threads, to observe the following rule, still supposing that the quilling is to consist of one hundred threads; this number will divide by five or ten; or in case it be sixty threads, it will divide by five or twelve, or any number which will divide in like manner will do; but numbers which will not divide in this manner, for instance, sixty-one, twenty-three, or one hundred and three, which will not divide by any number, they, consequently, are not proper numbers to spot with. Note.—The spotting-bars are, as usual, kept to act against the spotting-wheels by springs.

Having now described the nature of my invention, and the manner of carrying the same into effect, I would have it understood, that I lay no claim to any of the

parts of a traverse warp-machine, fitted with the usual spotting-bars, that machine being well known; but wha I do claim, is, producing the motions above described to the ordinary spotting-bars in a traverse warp-machine, whereby I am enabled, by taking certain of the warp-threads, to cause them to act alternately as spotting-threads and warp-threads, to produce quillings of bobbin-net having spots therein which are formed by the same threads which also work in and form part of the plain net as above described.—In witness whereof, &c.

Enrolled August 22, 1832.

Specification of the Patent granted to Samuel Parlour, *of Croydon, in the County of Surrey, Gentleman, for certain Improvements on Lamps, which he denominates Parlour's Improved Table Lamps.*—Sealed December 13, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Samuel Parlour, do hereby declare the nature of my said invention to consist in causing the oil required to feed the cotton or wick of an Argand burner, to rise and be kept up to the wick by the pressure of a column of water, or other suitable transparent fluid (the specific gravity of which is heavier than oil), descending from an elevated transparent reservoir, the transparency of which reservoir, and of the fluid, prevents any shade being cast from the lamp thereby. And in further compliance with the said proviso, I, the said Samuel Parlour, do hereby describe the manner in which my said invention is to be performed, by the following description thereof, reference being had to the drawing annexed, and to the figures and letters marked thereon (that is to say):—

Parlour's Patent

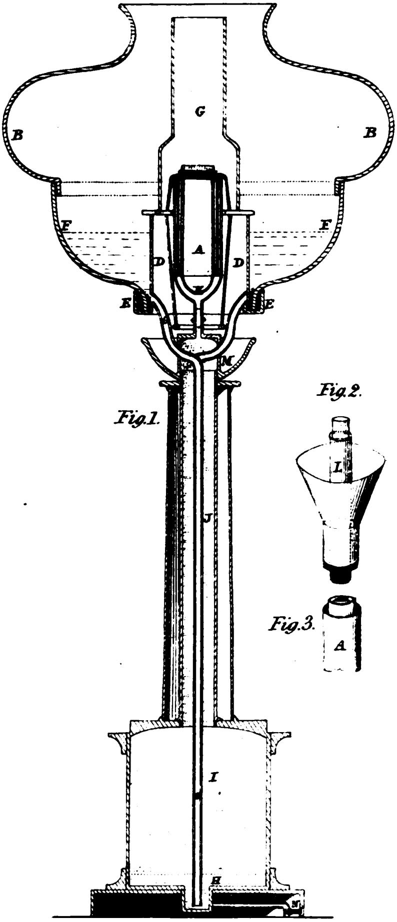


Fig.1.

Fig.2.

Fig.3.

Cook's Patent

Fig.1.

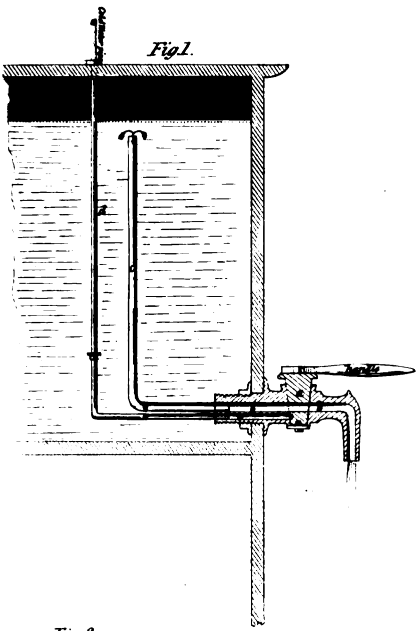
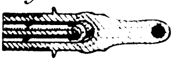


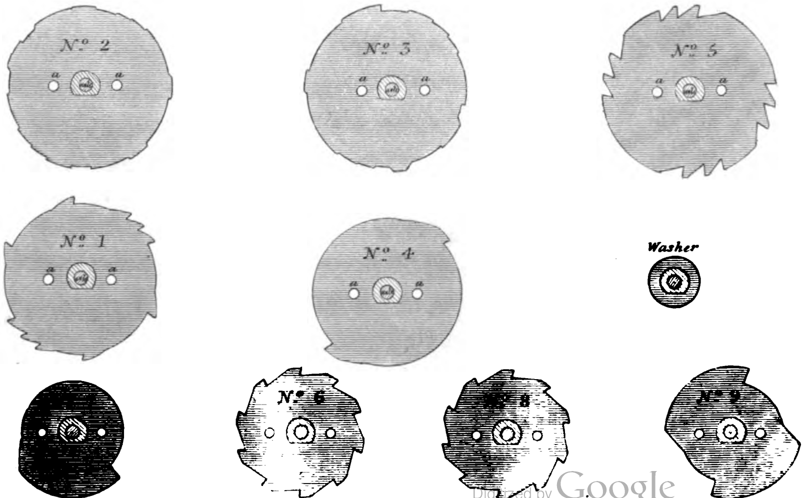
Fig.3.

Fig.2.

Fig.4.



Freeman's Patent



Description of the Drawing.

Fig. 1, represents a sectional elevation of a table-lamp with my said improvements. A, is the ordinary Argand burner. B, B, the glass; and C, the chimney. D, D, is a brass cylinder enclosing the burner, and furnished with the socket-rim E, E. Into this socket is cemented the glass cup or reservoir F, F: this reservoir is supposed, in the present instance, to contain water, which, flowing down the tube G, finds its way into the hollow pedestal of the lamp H, and supports on its surface a column of oil I, J, K, at which last letter it branches off into the burner. The oil is put into the lamp by means of a funnel which is screwed, or otherwise placed, on the top of the burner.

Fig. 2, represents the said funnel. L, is the mandrill for putting on the cottons, which I provide with a screw at one end, that fits into a female screw cut in the top of the burner, as shewn at fig. 3, which represents the top of the burner. M, is the receiver to catch the overflowing oil; and N, is a cock for drawing off the water, and oil, if necessary at any time to empty the lamp. It is only necessary to observe, that the glass cup or reservoir should be ground at the outside, so as to distribute the light more evenly.

Now whereas it is evident by this arrangement of the oil and water, that as fast as the oil is consumed, a fresh supply will be raised to the wick or cotton by the pressure of the column of water from the reservoir, while the transparency of the said reservoir, and of the fluid it contains, will prevent any shadow being cast from either.

And whereas I claim as my said invention, the raising of the oil to the wick or cotton, by the pressure of a column of transparent fluid flowing from a transparent reservoir, as aforesaid. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called

England; his said dominion of Wales or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled February 12, 1831.

Specification of the Patent granted to William Cook, *of Redcross Square, Cripplegate, in the City of London, Fireworker, for certain Improvements on Cocks for supplying Kitchen Ranges or Cooking Apparatus with Water, and for other purposes, to be called Fountain Cocks.*—Sealed September 7, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said William Cook, do hereby declare, that the nature of my invention, and the manner in which the same is to be performed, are particularly described and ascertained by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):—

My improvements relate to supplying water to boilers of ranges or cooking apparatus, and other boilers which are used for heating water, where part of the heated water is occasionally withdrawn, and the supply required to be continually kept up. Now, the object of my invention, is, the construction of cocks in such a manner, that the turning of the handles of such cocks shall open the water-way; whereby the heated water may be withdrawn; and by having a double way in the plug and barrel of such

cock, the cold water-way will be opened into the boiler; and these two ways being adjusted to each other, the boiler will always be supplied with an equal quantity of water to that which is withdrawn, and thereby doing away with the danger of the bursting of the boiler, from the circumstance of the supply of water becoming low; for by the application of cocks with my improvements applied thereto, the boiler must at all times be properly supplied with water, and at the time of withdrawing of the water which has become heated, so that the water-mark, or height of the water in the boiler, will never vary. But, in order that my invention may be fully understood, I will describe the drawing hereunto annexed, which represents a section of part of a boiler with one of my improved cocks applied thereto.

Description of the Drawing.

Fig. 1, represents a section of the cock and the other parts connected therewith.

Fig. 2, an end view of the cock, which shews the hot water-way, and also two cold water supply ways.

Fig. 3, shews the plug separately; in each of these figures the same letters indicate similar parts. *a*, being the plug. *b*, the hot water-way; and *c*, a pipe connected therewith. *d*, cold water supply-pipe leading from a tank or reservoir, from whence the supply of water to the boiler is obtained: this pipe *d*, leading to the cold water-way *e*, and thence to the water-way *f*, when the plug is turned for the purpose of withdrawing hot water.

Fig. 4, is a section of the cock, for the purpose of shewing the cold water-ways *e*, and *f*.

Having now described the various parts, I will suppose that a quantity of hot water is to be withdrawn, by which I shall be able to trace the action which will take place in all the parts.—The cock is represented as being opened for the passage of the water, which will flow down the pipe *c*, into the water-way *b*; at the same time the cold

[illegible]

Having now described the various parts of my invention, and the manner of using the same, I would have it understood that what I claim as the [illegible] in the manner above described, and applying the same to the supplying of water to [illegible] and working apparatus, and to other purposes—in [illegible] [illegible]

[illegible] March 7, [illegible]

water will descend from the supply-tank, by the pipe *d*, into the cold water-way *e*, and thence through the plug into the water-way *f*, into the boiler; and thus the boiler at all times will be supplied with a quantity of water equal to that which is, from time to time, withdrawn; and the hotter part of the water will at all times be taken away, in consequence of the pipe *c*, ascending to just below the water-line in the boiler; and the water can never be drawn through the cock, unless the water-line be above the pipe *c*. Now it will be evident, that the cold water-way should at all times be less than the hot water-way, in proportion to the altitude of the tank from which the water is supplied, to compensate for the downward pressure of the column of water, and also to compensate for the expansion of the water when in a heated state. And it is also evident, that this arrangement of the supply may be varied. In the present instance the cold water supply-pipe is made to pass through the boiler; but it may be made to pass direct to the cock, and it will be further evident, that this arrangement may be applied to all sorts of boilers where the changing of the water therein is desired, as above described.

Having now described the various parts of my invention, and the manner of using the same, I would have it understood, that what I claim, is, the constructing of cocks in the manner above described, and applying the same to the supplying of water to kitchen ranges and cooking apparatus, and to other purposes.—In witness whereof, &c.

Enrolled March 7, 1831.

Cowper's Patent

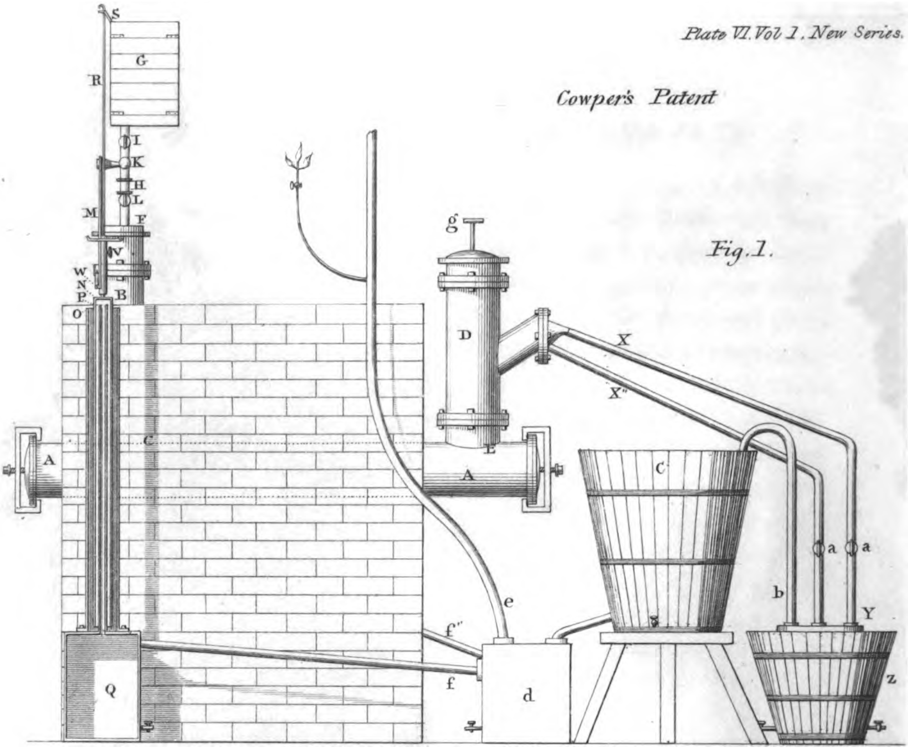


Fig. 1.

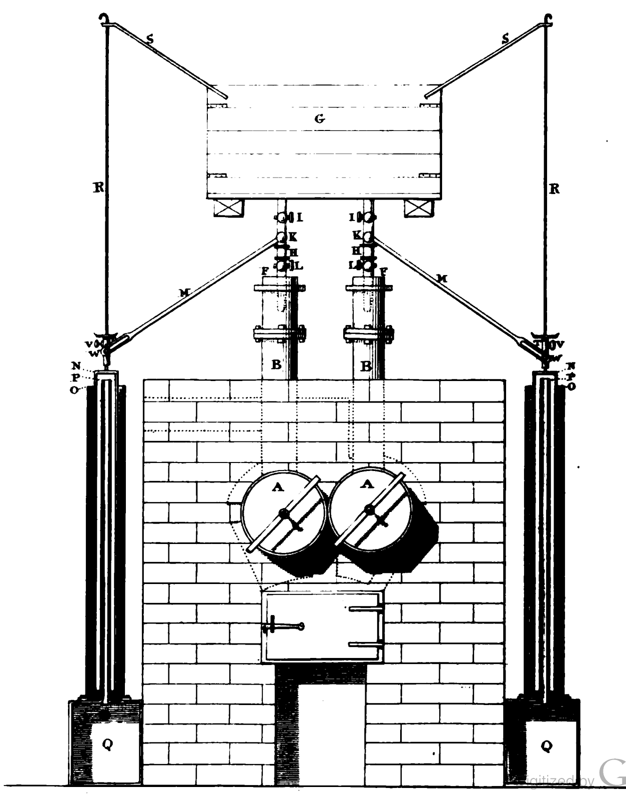


Fig. 2.

London. Simpkin & Marshall for the Proprietor March 1. 1834.

Specification of the Patent granted to EDWARD COWPER, *of Streatham Place, in the County of Surrey, Gentleman, for certain Improvements in the Manufacture of Gas. Communicated by a Foreigner residing Abroad.* —Sealed February 12, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Edward Cowper, do hereby describe the manner in which the said invention is to be performed, by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):—

The said invention relates to the manufacture of gas from oleaginous fluids, such as oil, solution of rosin in spirits of turpentine or spirit of coal-tar, or fatty substances, such as concrete cocoa-nut oil rendered fluid by heat. In the following description the term "oil" is used to denote any such fluid substances. The invention consists in regulating the supply of oil to the retort, in exact proportion to the quantity of gas consumed, by means of a self-acting governor or regulator; in consequence of which, the large reservoir of gas, commonly called a gasometer, is rendered unnecessary. The annexed drawing represents an apparatus suitable for fifty or sixty burners.

Description of the Drawing.

Fig 1, is a side elevation; and

Fig. 2, a front elevation: similar letters of reference indicate similar parts. A, a retort of cast-iron, having an elbow or ascending pipe B, at right angles to the retort at C, and another elbow or ascending pipe D, at E. To the elbow B, is fixed the feed-pipe F, connected with the cistern of oil G: a small glass tube may be introduced

at H, for the purpose of ascertaining when any stoppage occurs in the feed-pipe. The feed-pipe is furnished with three cocks I, K, and L; to the cock K, which is the feed-cock, is attached a lever M, which is worked by the regulator N. The feed-cock has a passage of rather more than the eighth of an inch diameter: it is open when the lever is horizontal. The apparatus of the regulator consists of three concentric metal tubes arranged like the water-joint in gas apparatus; the outer tube O, is about three feet high, and about four inches diameter, closed at the bottom and open at the top. The inner tube P, is open at the top, and also open at the bottom into the iron box Q. The other tube N, is the regulator; it is open at the bottom and closed at the top, and is placed between the other two tubes O and P, the space between which is filled with water. To the top of the regulator is fixed a wire or light rod R, running through a hole in the bracket S, to steady it: a cord may be attached to the end of this rod, and carried over a pulley, with a balance-weight at the other end: a brass boss T, furnished with a small tray to hold weights to produce the pressure required, slides on the rod R, and may be fixed at pleasure by the set-screw V. On the brass boss is a stud W, which works in the fork of the lever M, and thus connects the regulator with the feed-cock K: a small pin in the stud keeps the lever from slipping off the stud. To the elbow D, is attached a pipe X, leading to the condensing box Y, which is a thin metal box standing in a tub of water Z. X″ is supposed to be the pipe from the other retort: these pipes are furnished with cocks at *a*, *a*. A pipe *b*, ascends from the condensing box to the refrigerator or worm-tub *c*, which exactly resembles a distiller's worm-tub, being a spiral pipe immersed in a tub of water. The end of the pipe enters the deposit-box *d*, which receives the deposit of condensed vapour, &c.: a pipe *e*, goes from this box to the burners; and another pipe *f*, goes to the box of the regulator Q. *f″*, is supposed to be a pipe

going to the other regulator. *g*, a rod working through a stuffing-box attached to a piston formed of a plate of iron loosely fitted to the insides of the elbow D, is occasionally drawn up and down to clean it. The action of the apparatus is as follows:

Put some broken pieces of coke into the retort, and close the ends air-tight, in the usual manner, and heat the retort to a cherry red. Detach one of the levers M, from the regulator, and raise the lever a little above the horizontal position; then open the cocks I and L, and a portion of oil will descend into the retort, gas will be immediately formed, and the regulator N, will rise, as soon as the stud W, of the boss T, reaches the fork of the lever, the lever is slipped on to the stud and kept there by the small pin, and then the apparatus regulates itself as effectually as a ball-cock regulates the supply of water to a cistern; and as the ball floats upon the water, so the regulator may be said to float upon the gas. Thus in an apparatus for one hundred burners, if fifty are extinguished, the regulator immediately ascends, and closes, or partially closes, the feed-cock; if the fifty burners are again lighted, the feed-cock instantly opens to supply a quantity of oil, in exact proportion to the consumption. If all the burners are extinguished, the regulator rises and remains up, and completely shuts the feed-cock, and no more gas is produced, for the regulator will not descend till the cock of the burners are again opened. If the fire under the retorts be allowed to go out, and the retorts become cool, of course the gas would cease to be formed; in this case the regulator would descend rapidly, and the feed-cock would rapidly pass the open position, and then become quite closed, allowing time for only a small portion of oil to pass; so that the retort, even in this case, would not become surcharged with oil.

The dimensions of the regulator are shewn in the drawing, at a minimum for an apparatus of fifty or sixty common burners; it may be made with advantage of twice

the diameter, but it is disadvantageous to exceed three times the diameter shewn, as its action upon the feed-cock would be too slow, so that the ordinary gasometer would not answer the purpose: an objection of an opposite nature lies against the application of a valve, as in the feed-pipe of a steam-boiler. A cock opens gradually, but a valve opens suddenly; and if the regulator were made to lift a valve, too large a portion of oil would flow into the retort; and to connect a valve with a common gasometer, would only increase the evil, as the valve would be kept open too long, and be kept closed too long, sometimes overcharging and sometimes undercharging the retort, instead of the exceedingly regular supply and sensitive movement of the above apparatus. It should be observed, that this regulator differs most materially from a gasometer or reservoir of gas, inasmuch as the gas consumed does not pass through the regulator; whereas all the gas in the ordinary apparatus passes through the gasometer. It is desirable to have two retorts and two regulators, as shewn in the drawing, so that if one retort should crack, or the feed-pipe by accident become choked, the cocks connected with that retort may be shut, when the other regulator will instantly admit twice the quantity of oil, and continue to regulate the supply.

I make no claim to the materials, nor to the apparatus for producing the gas or condensing the vapour, &c. but I claim the method of regulating the production of the gas by its consumption, by means of the regulator and feed-cock hereinbefore described.—In witness whereof, &c.

Enrolled August 12, 1830.

Specification of the Patent granted to THOMAS WALMSLEY, *of Manchester, in the County of Lancaster, Manufacturer, for Improvements in the Manufacture of Cotton, Linen, Silk, and other Fibrous Substances, into a Fabric or Fabrics, applicable to various useful Purposes.*—Sealed December 13, 1830.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Thomas Walmsley, do hereby declare, that the nature of my said invention is particularly described and ascertained in and by the following description thereof (that is to say):—

My invention consists in producing a fabric or fabrics of cotton, linen, silk, or any similar fibrous substance, separately or mixed, by combining the fibres, when arranged in layers or fleeces, with starch, flour paste, glue, gum, or other glutinous substance.

This combination or method of producing a fabric, may be effected in various ways, one of which is as follows, and is the method I have practised.—The cotton, linen, silk, or other fibrous substance, is opened or teazed, and prepared for carding, by the usual process employed in the manufacture of the respective substances. It is then passed through a carding engine, such as is employed in the carding of cotton, and delivered from the doffer in a thin fleece or flake, on to an endless cloth, the surface of which moves at about the same speed as the periphery of the doffer cylinder. This endless cloth is as wide as the doffer cylinder, and as long as can be conveniently used, say eight or ten yards, and has three or four smooth rollers applied to its surface, at different parts, for the purpose of slightly compressing the successive layers of fibrous substance which are laid on to the cloth as it revolves. When, by the accumulation of layers, the lap or fleece is of sufficient thickness, it is

broke or cut across, and carefully removed from the cloth, and in this state is passed through a machine or apparatus for compressing and impregnating it with starch, flour paste, or other glutinous substance, and subsequently drying it. This machine consists of a pair of smooth revolving cylinders or rollers, which I generally use of about six inches in diameter, covered with woollen cloth or other suitable material; the one placed over and resting upon the other, and pressed down by weighted levers or other means; and the under roller partly immersed in a trough containing a solution of starch or other glutinous substance with which the fibrous lap or fleece is to be impregnated. This trough is provided with a straight edge or doctor for the purpose of regulating the quantity of glutinous matter taken up by the under roller. Connected with these rollers and geared with them, are a series of drying cylinders about twelve inches diameter, which revolve at a speed to give the same surface motion as that of the surface of the starching rollers. The action of this machine is as follows:

The fibrous fleece or lap, as produced by the carding engine, being spread out lengthwise upon an endless feeding-cloth, which revolves upon rollers placed in front of the starching cylinders, is slowly passed through between the said starching cylinders, by which the glutinous matter brought up by the under cylinder as it revolves in the trough, is forced through the fibrous texture of the fleece or lap, so as to combine effectually the glutinous with the fibrous matter. The impregnated fleece or lap in its further progress, is conducted alternately over and under the drying cylinders, until it is at length delivered in a dry state fit for use, or to be calendered, printed, stained, embossed, or otherwise ornamented. The construction and arrangement of the starching rollers are similar to those employed in the dressing of cotton yarn for power-loom warps; and the construction and arrangement of the drying cylinders are similar to those

employed by bleachers and dyers in drying cotton goods.

Having now described the nature of my invention, and fully explained how my fabric or fabrics of cotton, linen, silk, or other fibrous substances, either separately or mixed, may be produced, I declare that the same effect of forming a lap or fleece of fibrous substances may be produced by receiving the fibrous substance from the doffing cylinder of a carding engine, on to the periphery of a revolving drum, or on to the surface of a cloth having a reciprocating motion endwise; and that the same effect of compressing the fleece or lap, and forcing the glutinous substance into the fibrous texture, may be produced by means of flat blocks and presses, or by any of the ordinary means of effecting great pressure; and that the drying of the saturated fleece or lap may be effected, though not so advantageously, without the use of drying cylinders, by any of the ordinary means employed in drying fabrics of cloth. But I do not claim as of my invention, the separate parts of the apparatus by which the before mentioned operations are, or may be, performed; but I declare that I do claim the application thereof for the purposes hereinbefore described, in order to effect, by means of an adequate pressure, an entire combination of the fibrous substance used with the glutinous matter employed. And I also claim as of my invention, any fabric or fabrics produced by the means herein described, or by any method or process producing the same results, though effected by any of the means now in common use.—In witness whereof, &c.

Enrolled June 11, 1831.

Specification of the Patent granted to CORNELIUS WHITEHOUSE, *of Wednesbury, in the County of Stafford, Whitesmith, for certain Improvements in Manufacturing Tubes for Gas and other Purposes.*—Sealed February 26, 1825.*

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Cornelius Whitehouse, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof (that is to say):—

My improvements in manufacturing tubes for gas and other purposes, consist in heating the iron of which such tubes are to be made, in a blast furnace; and immediately after withdrawing them from the furnace, passing them through swages, or other such like instruments, in manner following: I prepare a piece of flat iron, commonly called Plough-Plate Iron, of a suitable substance and width, according to the intended caliber of the tube. This piece of flat iron plate is prepared for welding by being bent up on the sides, or as it is commonly called, turned over, the edges meeting, or nearly so, and the piece assuming the form of a long cylindrical tube. This tube is then put into a hollow fire, heated by a blast; and when the iron is upon the point of fusion, it is to be drawn out of the furnace by means of a chain attached to a draw-bench, and passed through a pair of dies of the size required; by which means the edges of the iron will become welded together.

* We insert the above specification at this late period, in consequence of the value of the invention, and to give our readers the information which is necessary to a clear understanding of the trial at law, Russell against Cowley, which we have reported at page 166.

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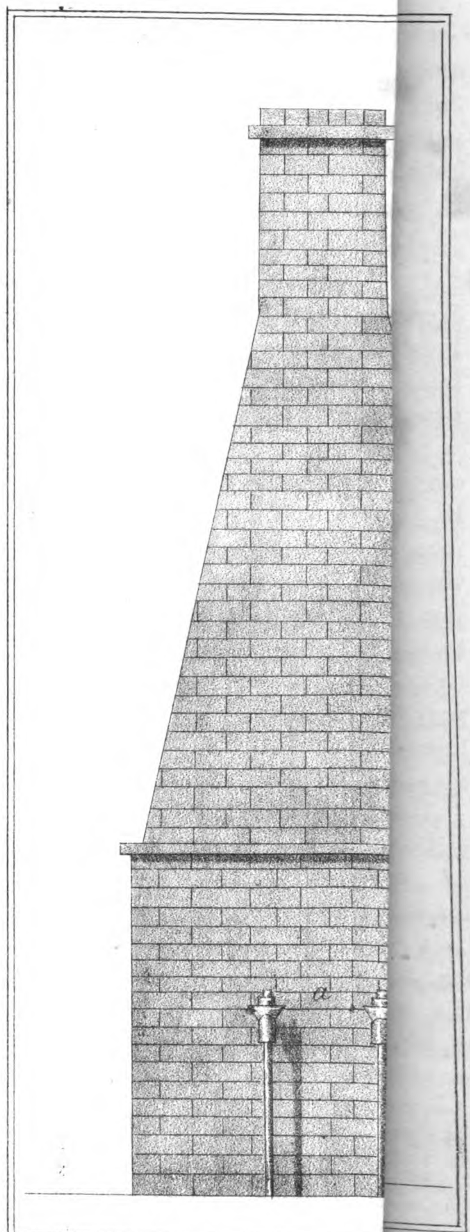

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Description of the Drawing.

The apparatus which I employ for this purpose is shewn in the drawing at fig. 1, which is a side view of the furnace *a*, and of the draw-bench *b*, with its spur-wheel *c*, which may be put in operation by a hand-winch, or by attaching its axle to the moving part of a steam-engine. *d*, is a screw-press, in which the dies are placed for swaging and uniting the edges of the iron tube *e*, as it passes through. A front view of this screw-press, with its dies, is shewn at fig. 2; and one of the dies removed from the press is shewn at fig. 3. The iron tube *e*, having been heated to the point of fusion in the blast furnace *a*, is drawn out by the chain of the draw-bench; and the screw of the press *d*, being turned so as to bring the dies to their proper point of bearing, the two edges of the iron become pressed together, and a perfect welding of the tube is effected. The screw-clamp or other fastening *f*, by which the end of the tube is held and attached to the chain, is now opened, and the tube removed; the reverse end of the tube is then grasped by it, and that part which has not been welded is introduced into the furnace, and after being heated, is drawn through the dies, and welded in the manner above described.

The process of welding these tubes may be performed without the screw-press and dies above described. A pair of pincers, as shewn at fig. 4, may be employed instead, having a hole for the tube to pass through, similar to the dies; one arm and chap of these pincers is shewn at fig. 5, for the purpose of exhibiting the conical figure of the hole which the tube is to pass through. As the tube *e*, is drawing out of the furnace by the chain of the draw-bench, a workman brings the pincers and takes hold of the tube, resting the pincers against the standard *d*, as a steadying place, and as the tube passes thróugh the hole of the pincers, the welding of the edges of the iron is effected.

I have thus described the modes which I have employed, and found fully to answer the purpose in welding tubes of iron; but I do not confine myself to the employment of this precise construction of apparatus, as several variations may be made without deviating from the principles of my invention, which is to heat the previously proposed tubes of iron to a welding heat, that is, nearly to the point of fusion, and then after withdrawing them from the fire to pass them between dies, or through holes, by which the edges of the heated iron may be pressed together, and the joint firmly welded. The advantage of this tube, compared with those made in the ordinary way, are these —the iron is considerably improved by the operation of the hollow fire, the heat being generally diffused the length of the pieces of tube thus made is likewise a great advantage, as by these means they may be made from two to eight feet long in one piece, whereas by the old modes the lengths of tubes cannot exceed four feet, without considerable difficulty, and, consequently, an increased expense. These tubes are likewise capable of resisting greater pressure, from the uniformity of the heat throughout at which they have been welded. And, lastly, both their internal and external surfaces are rendered smooth, and greatly resembling drawn lead pipes.— In witness whereof, &c.

Enrolled August 24, 1825.

LAW REPORTS OF PATENT CASES.

Court of Exchequer, Westminster, February 14, 1834.
Before Chief Baron Lyndhurst and a Special Jury.

Russell *v.* Cowley and Dixon.

This case came on for trial on Friday, February 14, under an order by the Lord Chancellor. Counsel for plaintiff Sir James Scarlett, Mr. Rotch, and Mr. Follett;

counsel for defendants, the Solicitor-general, Mr. Platt, and Mr. Richards.

Mr. Follett opened the pleadings.

Sir James Scarlett stated the case for the plaintiff. He said, this was an action against the defendants for an infringement of a patent obtained by a person of the name of Whitehouse, and assigned to Mr. Russell, the plaintiff. The question divided itself into two parts—whether the patent was for an original and useful invention, and if so, whether the defendant had infringed it. It rarely happens that an attempt is made to infringe a patent, unless it be useful; but when a patent is found to be useful, attempts are made to destroy the monopoly, and deprive the inventor of the advantages of his patent. That observation was never more fully illustrated than in the present case. The invention claimed by the plaintiff, is, "A new mode of manufacturing iron pipes for every purpose to which those pipes can be applied." There never was an invention that produced a more complete revolution in a trade than this. The original mode of making gas pipes was by means of a lathe to work out the solid iron, and make a bore in the pipe; whence came the word that is applied to gun barrels and cannon,—the *bore* of a cannon or gun: this was a most laborious and expensive mode. Another mode, was, to obtain the iron of the thickness required in a flat plane, and then to turn up the edges, so as to make them lap over; it was then heated to what is called a welding heat, and reduced to nearly a state of fusion, at which particular point of heat between the liqueform state of the metal, and a state of malleability, it admits of combination by means of hammers. The mode of welding, before the present patent, was, by inserting within a hollow tube, what was called a "mandrel," that is, a metal rod introduced into the tube to keep it in a circular form, and resisting the force of the hammers, which were applied till the edges of the metal assumed a solid form, and were united. This mode was inconvenient, for in a

long tube it gave time for part to cool, before the rest was finished; in cooling it contracted, and rendered it difficult to get the mandrel out. The inventor of the mode in dispute, was a person of the name of Whitehouse, who had been working for a length of time at Mr. Russell's factory, at Wednesbury: he tried the experiment of drawing turned up plate iron, when at a welding heat, through dies having conical holes, so as to admit a tube on one side rather larger than the opposite side; and by drawing it compressed the edges, and gave the required formation to the tube. The experiment was successful; the tube was completely welded without the necessity of the mandrel. When this invention came into the market, it reduced the price of tubes one-third. The patent was for the mode of manufacture, and not for the apparatus itself.

The learned counsel then described minutely from a model and various instruments and tools, the mode pursued by the plaintiff, of drawing the tubes through dies at a welding heat.

The advantages of the present patent were, not only as it afforded a more rapid mode of welding and forming tubes, but because thereby tubes of increased lengths, greater force of resistance, and greater uniformity both internally and externally, were manufactured, and also from their being applicable to a greater variety of purposes. The superiority of this mode was so apparent, that immediately after the passing of this patent, almost all the tubes that were wanted were supplied by Mr. Russell.

A person of the name of Royal was in the plaintiff's employ, and afterwards went into that of defendants': he was the person said to be the inventor of defendants' method. Plaintiff obtained evidence that defendants' method of manufacture was an infringement of his patent; he filed a bill in the Court of Chancery, and an order was obtained for the inspection of defendants' process. Two

scientific gentleman were sent down on each side as examiners; Mr. Donkin and Mr. Brunel for plaintiff, and Mr. Clegg and Mr. Bramah for defendant. Defendants' mode was to pass the tubes between two rollers with grooves in them; and it is contended they were completely welded by this process. If this was the only process used by defendants for the purpose of welding, plaintiff would not have instituted this inquiry, but defendant, after passing the tubes through the rollers, while they are in a welding heat, passes them through what they call a "scorpion" which is nothing more than plaintiff's die, and by that means produce all the effect of plaintiff's method. Defendants contend, that the scorpion is only for the purpose of scraping and lengthening, and not for the purpose of welding: but it would be shewn, that the welding could not be completed without the scorpion, by rollers alone. The imitation consisted in passing the tubes, in a welding heat, through these dies; and if this point was established, plaintiff's case would be established. Defendants say, that they do not weld by the scorpion, but by the cylinders,—that the scorpion is fifteen feet from the furnace; and before the tube could be conveyed that distance, it grows too cold to be in a welding heat. Plaintiff admits that there is a weld by passing through the rollers, but a very imperfect one; and tubes welded only by this means would not be marketable. If defendants' scorpion was only for the purpose of scraping, why make it bell-mouthed? It has been said by defendants, that they cannot pass their tubes through the scorpion at a welding heat, because they pour water on the scorpion; but it will be proved, that the heat of the iron is so intense, that even if you pour water on the iron itself it produces no effect, but it is still at a welding heat. As to distance, it will be shewn, that, in stead of fifteen feet, it will continue at a welding heat though carried a distance of fifty feet, it retains a sufficient heat for seventeen or eighteen seconds; whereas it

may be carried from the furnace to the scorpion in less than two seconds, and by a second and a half more it is put into the scorpion and finished. The rollers are a perfect subterfuge, and only introduced to give a colour to avoid plaintiff's patent. An attempt had been made before the chancellor, to shew, that the original inventor and patentee of plaintiff's mode of manufacturing, was a person of the name of Cook; but that gentleman would prove himself, or it would be proved for him, that ever since the plaintiff's invention, he has ordered various quantities of the pipes from plaintiff. Was it not odd, that Cook should say, "I am the inventor of this method of manufacturing, and have a patent for it," and yet be at the trouble of purchasing the tubes from plaintiff?

The learned counsel then explained from a model, the principle of Cook's patent, of passing the iron through a series of graduated holes, pressing it first through a large hole, then through a smaller, then through a smaller still, and so on until it assumed the form of a tube.

But, as the learned counsel contended, there was no welding here at all; and the process is so laborious and expensive, that it is not worth one farthing. But if the process in dispute were known before, how came the plaintiff, when he had patented this method, to carry the market before him in the manner he did? That is a sufficient answer to this objection. But when it was found how eminently successful the plaintiff's method was, then these attempts were made to evade or upset it. No doubt every thing that legal skill would do for this purpose, would be done by the learned Solicitor-general.

The plaintiff's patent, and specification of, were then put in, and read by the officer of the court, and also the specification of Royal's patent.

Mr. Bryan Donkin, examined by *Mr. Follett.*—Has been a civil engineer for forty years. Has seen iron tubes made, but not in a large way. Went down by order of the Court of Chancery with Mr. Brunel, to Mr. Russell's

works, last August. Witness first read the specification, and then inspected the works in their ordinary mode of working.

What they call a "skelp" was afterwards heated to a welding heat in one furnace, and then carried to another at the distance of about fifty-five feet; it was then drawn through the tongs and found to be perfectly welded. The welding heat continued while the tube was taken from one furnace to another, a distance of fifty-five feet. The dies were conical dies. The pincers used by defendant answer the same purpose as plaintiff's dies. The object of the experiment of taking the tube fifty-five feet, was, to ascertain whether it would retain a welding heat for that distance, which it did. They (witness and Mr. Brunel) next examined the sand, to see if there were any borax or other matter mixed along with it, but found it was merely sileceous sand. The place about the furnace mouth was strewed with sand; in drawing out the tube at a welding heat they drew the edge over the bed of sand, and then replaced it in the furnace. The object of using the sand was to prevent the access of the atmospheric air operating on the iron; it was the same sand as is constantly used by blacksmiths. Another tube was then tried, and found not to be welded. Another, the length of seven feet, had the appearance of being sound, but was afterwards found not to be so. The time in which a 3-feet 6 tube was passed through the die, was three seconds and a half. The failures were owing to the agitation of the man, who was quite in a tremor. The time of passing from one furnace to the other occupied about ten seconds. Several tubes of about one inch in diameter were done in the same way. Some of what the workmen call "Layter," which is the *scoria* from the tube, was caught in a shovel, in a semi-fluid state; in a subsequent drawing the scale came off. The tubes pass through three holes, in order to reduce them to a proper size, and the welding heat continues all the time. The tubes are

lengthened considerably each time they pass these holes; one of 5-feet 6, was drawn out to 8 feet. Seven tubes were drawn half their length at the distant furnace, and the other half at the furnace at which they were heated; these were passed four times through the tongs; one was spoiled by over-heating; another would not stand the proof: the five remaining stood the proof of 168lbs. to the square inch. Took one of them and cut it in pieces, and found it was properly welded. Some of the tubes were tried with 5,450lbs. to the square inch. Went the next day with Mr. Brunel, Mr. Carpmael, and young Mr. Russell, and then saw the screw-press and dies used, which is another mode mentioned in the specification; and saw several tubes made by that means. This mode was found to answer; but the tongs were the most convenient method. After this went to the defendants' manufactory, Messrs. Cowley: Mr. Bramah and Mr. Clegg were there. Saw the rollers which have been described, making about 120 revolutions per minute. Asked Mr. Cowley if that was their ordinary mode of working, and he said, they had no other. The workmen were then employed in drawing tubes of about one inch diameter to pass through the rollers. The tube was drawn through a hole by a revolution of the rollers, without the chain. The grooves in the rollers were nearly cylindrical. The scorpion is about fifteen feet from the furnace; the scorpion is an instrument with three graduated conical holes in it; it was fixed on a cast-iron frame. This instrument is precisely the same as the tongs at Mr. Russell's. The tubes were passed four times through the rollers, and put back into the furnace between each time; the tubes were allowed to remain longer in the fire than at Mr. Russell's. After being passed through the rollers, they were taken to the scorpion.

The mode of working of the defendants was here described from a model and instruments.

The tubes were passed through the scorpion at a weld-

ing heat. Some were then made by the rollers only; some of these were welded as well as those passed through the scorpion; others were imperfectly welded, not at all in some parts. Those that passed through the rollers are very liable to injury from the bad shape, one part of the iron being driven past the other: this arises from the pinch of the rollers. Gas pipes might be made by this means, but they would not be marketable. Those that were passed only once through the rollers would not stand a sufficient pressure for gas pipes; they gave way at a very low pressure: two were passed twice and stood the pressure, but they were of a bad shape; they were oval-shaped; they were made so that they could not be screwed together; they were not fit for gas pipes; this arises from not having passed sufficiently often through the rollers; they ought to pass four times through the rollers to be properly welded. Does not believe it possible to make a cylindrical pipe through rollers, on account of the irregularity and uncertainty of the pressure.

Chief Baron.—The rollers, according to this evidence, are perfectly useless. What is the use of passing them through the rollers in the first instance, and afterwards through the scorpion?

Sir James Scarlett.—It is perfectly useless.

The Solicitor-General.—The scorpion is for lengthening and scraping.

Chief Baron.—The scorpion is a process in the form of the tongs, according to the appearance of it and Mr. Donkin's evidence, and it passes through at a welding heat; the scorpion is like the tongs; passing through the tongs they are perfect, therefore passing through the scorpion they are perfect; therefore the rollers are of no use.

Mr. Donkin continued.—Requested Mr. Cowley to allow some tubes to be made by the scorpion only, but he refused. Mr. Bramah was there at the time and approved of the proposal. Mr. Hooper (plaintiff's solicitor) repeated the request; Mr. Cowley said if they were to do that they would be infringing Mr. Russell's patent.

Requested Mr. Bramah and Mr. Clegg to come to plaintiff's factory, and see it done there, which they did the next day.

Chief Baron.—Was that refusal mentioned to the Chancellor?

Solicitor General.—The order was that they were to see the manner in which the business was conducted on the part of the defendants; and they did so.

Sir James Scarlett read two orders of the Lord Chancellor.

Mr. Donkin continued.—At the defendant's factory next day, the experiments before-mentioned were repeated in the presence of Mr. Bramah and Mr. Clegg, of heating the tubes in one furnace, and then taking them to the distant one; the distance between the two furnaces was measured by Mr. Bramah and Mr. Clegg, and found to be fifty-five feet. Seven tubes were welded in the usual manner, passed twice through the tongs, and were found some united, and one perfectly welded. The time occupied was seventeen or eighteen seconds from the time of leaving the first furnace to the end of the second drawing, and the iron continued at a welding heat; the screw-press and the die were also tried in the presence of Mr. Bramah and Mr. Clegg. Some objection was made by Mr. Dixon and Mr. Clarke (defendants' solicitor) about the sand; one tube was made without sand, but it was found bad; this was the only one made without sand. An experiment was afterwards tried to ascertain whether the welding heat continued after passing through the tongs; the tubes were drawn at the furnace mouth, some once and some twice, and taken to the anvil at eighteen feet from the furnace, and there hammered together, and found perfectly welded. The tubes made at defendants' factory by the rollers alone were not fit for the market, but those made by the rollers and the scorpion were as good as Mr. Russell's, with the difference of the shape only. Has read the specification and seen the method of working at plaintiff's, and also the mode of working at defendants',

and considers the passing through the scorpion at defendants' an infringement of plaintiff's patent; if the rollers are taken away it is precisely the same as plaintiff's. But very few tubes per day could be made by defendants' method.

[*To be concluded in our next.*]

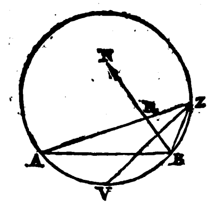
PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

GRAPHICAL CONSTRUCTION FOR THE MOST ADVANTAGEOUS COURSE OF A SHIP.—In the *Lond. and Edin. Phil. Mag.* for January we find a paper by the Rev. J. Challis, containing an analytical solution, in a manner (applying the calculus of variations) not before attempted, of the problem of what is termed by mathematicians "*the Brachystochronous Course of a Ship,*" i. e. the course which, with a given wind, will bring the vessel to its destined port in the shortest possible time. Mr. Challis has devoted himself with great and deserved success to the analytical investigation of the motions of fluids and of motions propagated in them, together with, as in the present instance, that of the laws of the motions of solids in fluids: the solution now before us is not only highly interesting to mathematicians, as a novel mode of treating the subject, but it is also important to practical men, as affording a simple and elegant graphical construction for the most advantageous or brachystochronous course. This construction is as follows:—

Let it be required to sail from A to B, in the shortest time possible, the wind blowing from B towards N, and the angle being given, which is made by the ship's course with the direction of the wind, when it first begins to be of advantage to tack instead of proceeding in the direct course between the two places.

Denoting the given angle by α, and $180°$, as usual, by π:



upon A B describe a segment of a circle A Z B, containing an angle equal to $\pi - 2\alpha$. Complete the circle, and bisect the arc A V B, in V. Draw V Z perpendicular to B N and join A Z, Z B. Then A Z B is the course required; for as A Z B$=\pi-2\alpha$, each of the angles Z R B, Z B R, is equal to α.

Correct fusing points of Metals and Alloys, and other important Temperatures, upon various Thermometrical Scales.—In the thirteenth edition of Parkes's Chemical Catechism, edited by Mr. Brayley, jun. which has just appeared, we find a "Table of the Effects of Heat" (p. 606), in which the higher temperatures have been corrected by the editor, agreeably to the pyrometrical researches of Mr. Daniell and other chemists. As we do not remember to have seen any connected view of the results, as to the correct fusing points of metals and alloys, &c., which Mr. Daniell has obtained by the use of his new register pyrometer, we subjoin an extract from this table, containing the temperatures from 212° upwards. It may be requisite to state, for the information of such of our readers as may not be acquainted with the present state of pyrometry, that Mr. Daniell has shown (as we find it explained by Mr. Brayley at p. 70, *notes*, of the Chemical Catechism), that "the degrees (above the zero of 1077° Fahrenheit, which is stated to be a red-heat visible in the daylight) of Wedgwood's pyrometer, instead of being equal to 130° of Fahrenheit, as supposed by its inventor, are equal only to about 20°;" and that consequently the *range* of that instrument, instead of including 3200 degrees of Fahrenheit, did not really include more than about 5000°: this will account for the great difference of the corresponding temperatures of Fahrenheit, &c. and Wedgwood, as here stated from the new edition of the Chemical Catechism, from those given in former editions of that work, and also in many other publications on chemical subjects.

Fusing points, &c. on the scales of	Fahren.	Reaum.	Cent.	Wedg.
Water boils, and " fusible metal" [$\frac{8}{16}$ bismuth, $\frac{5}{16}$ lead, $\frac{3}{16}$ tin, smelt]....	212	80	100	
Sulphur melts....................	216	89	111	
Nitrous acid boils.....	242	93	116	
Camphor melts.............	288	114	142	
Sulphur burns slowly................	303	120	150	
Pewter melts, lead $\frac{4}{5}$, tin $\frac{1}{5}$............	403	165	206	
Tin melts	442	182	227	
Type metal melts [lead 16 parts, antimony 1?.................. ..	507	211	264	
Sulphuric acid (Sp. gr. 1·848) boils.....	590	248	310	
Lead melts	612	258	325	
Mercury boils......................	662	280	350	
Zinc melts..........................	773	329	412	
Iron a bright red in the dark......... Hydrogen gas burns?	800	341	427	
— red in the twilight	884	386	475	
— red heat in daylight..	1272	551	700	
Enamel colours *burnt*, or *burnt-in**, on porcelain..........................	1392	605	756	6
Bronze melts, copper $\frac{3}{4}$, tin $\frac{1}{4}$..........	1446	629	786	
————————, copper $\frac{7}{8}$, tin $\frac{1}{8}$..........	1534	668	835	
Diamond burns?	1552	676	845	14
" Orange heat" (Prinsep)	1650	719	899	
Brass melts, copper $\frac{1}{2}$, zinc $\frac{1}{2}$..........	1672	730	911	
————————, copper $\frac{3}{4}$, zinc $\frac{1}{4}$..........	1690	737	921	21
Bronze melts, copper $\frac{15}{16}$, tin $\frac{1}{16}$	1750	794	955	
Silver melts........................	1873	818	1023	28
Copper melts	1996	862	1091	
Gold melts..........................	2016	860	1102	
Delft-ware fired	2072	967	1179	40
Cast-iron melts......................	2786	1224	1420	
Cream-coloured stone-ware fired	2992	1316	1645	86
Temperature of the maximum of expansion of platinum, being nearly the highest degree of heat attainable in a laboratory wind-furnace.......	3280	1444	1805	
Flint-glass furnace, greatest heat?......	3552	1253	1956	114
Soft iron melts, according to Clement and Desormes, but in all probability an estimate considerably above the truth	3945	1406	2118	

* This is a technical term used by enamellers, glass and porcelain painters, &c. to denote the fixing of the colours they employ, by means of vitrifaction, on the substances painted upon.

Mr Brayley observes, at the end of the table, "The still higher temperatures, derived from the experiments of Mr. Wedgwood, which were here given in former editions of the Chemical Catechism, are now omitted; a comparison of them with the results obtained by Mr. Daniell, by means of his pyrometer, having shown that they cannot be relied upon. Some of the temperatures given in this Table above that of ignition, or 800°, must also be regarded as doubtful, and all of them must be regarded as approximative merely.

Optical means of distinguishing minute Portions of Lithia and Strontian from each other.—Among other facts relating to optical science, published by H. F. Talbot, Esq., M.P., F.R.S., in the London and Edinburgh Philosophical Magazine for February, are the following observations "*On the Flame of Lithia*," pointing out a new method of distinguishing minute portions of that substance from the earth strontian.

Lithia and strontian are two bodies characterized by the fine red tint which they communicate to flame. The former of these is very rare, and I was indebted to my friend Mr. Faraday for the specimen which I subjected to prismatic analysis. Now it is difficult to distinguish the lithia red from the strontian red by the unassisted eye. But the prism displays between them the most marked distinction that can be imagined. The strontian flame exhibits a great number of red rays well separated from each other by dark intervals, not to mention an orange, and a very definite bright blue ray. The lithia exhibits one single red ray. Hence I hesitate not to say, that optical analysis can distinguish the minutest portions of these two substances from each other, with as much certainty, if not more, than any other known method."

Test for Hydrocyanic or Prussic Acid, and Method of appreciating the Quantity.—We are informed by Mr. John T. Barry, that the nitrate of silver, in common with other salts of that metal, is so extremely

delicate a test of the presence of hydrocyanic acid, that its detection is not difficult in a drop of water containing far less than *the ten-thousandth part of a grain* of that poisonous agent. For instance, if one minim of the dilute medicinal solution be mixed with a pint of water, its presence may be demonstrated in a single drop of the mixture. But what is of more consequence, is, that although the mixture be contaminated with various organic substances, such as those contained in articles of diet, milk, coffee, tea, porter, wine, and soups, so far as is yet known, the test retains its sensibility unimpaired. Mr. Barry, however, thinks that this extreme sensibility, while it renders the evidence of the silver test conclusive as to the *absence* of prussic acid, will be of more limited service in establishing its *presence*, for, without adverting to the possibility of other volatile substances being hereafter discovered to have a similar effect on solution of silver, it is to be borne in mind, that this re-agent indicates the existence of prussic acid in some esculent substances where it had previously been found, as well as in some new ones. Upon this branch of the subject, medical jurists will probably think it right to collect information.

The application of the solution of silver is simple. The suspected fluid is to be acidulated by the addition of acetic acid, but so as to redden litmus paper in only the *slightest degree*. If excess of acid be already present, it is to be *not quite* neutralized by carbonate of soda. These precautions are adopted to retard the interference of ammonia or muriatic acid. Two or three drops, quite cold, are then put into a watch-glass, and immediately covered by a plate of glass, whose under surface, to the breadth of a pea, is moistened with solution of nitrate of silver, formed by dissolving one grain lunar caustic in 100 grains distilled water :—

If the inverted drop of silver solution retain its transparency unaltered, the *absence* of prussic acid is established; for had it been present, the silver solution would

in a few moments have become clouded by the formation of a *white* precipitate, an effect which, indeed, is almost instantaneous when the prussic acid is not excessively diluted. If, on the other hand, the precipitate appear, the conclusion must not be drawn that it is *cyanuret* of silver, until identified as such by two properties:—first, its speedy *re-solubility*, as denoted by the clouded drop becoming again clear, when *placed over* a vessel of caustic ammonia, in which respect it differs from the silver compounds of iodine and bromine:—and secondly, in retaining *unchanged* its pure white colour after exposure a few minutes to the sun's rays, or for a longer time, to daylight. As this property essentially distinguishes it from the compound of silver with chlorine, it is important to establish it by a separate experiment upon a somewhat larger portion of the precipitate, which should be obtained, by candle-light, by successively placing the inverted drop of nitrate of silver over renewed portions of the liquid in a saucer: as soon as the precipitate separates into distinct curd-like particles, it is ready for exposure to the solar rays.

Another property which distinguishes the cyanide (or cyanuret) of silver from the chloride, is, that upon being ignited in an open short glass tube, the cyanogen burns with a flame of the usual colour, leaving the metal pure, if sufficiently heated,—a quality the more valuable, as it furnishes an index to the *proportion* of prussic acid it represents, which, upon ordinary occasions, may be estimated as equal to one-fourth the weight of residual silver.

When, acting upon this principle, it is desirable to ascertain the *entire* quantity of prussic acid, it is to be obtained by slowly distilling over, in nearly filled closed vessels, about an eighth of the acidulated mixture under examination; rectifying it; re-acidulating by acetic acid, precipitating by *slight* excess of nitrate silver, washing with distilled water, only so long as the washings affect

litmus paper; drying at 212°; weighing:— and lastly, igniting and re-weighing.

The medicinal solution above referred to (as to be diluted for experiment in the proportion of one drop to the pint of water), contains, in round numbers, nearly a sixteenth of its own weight of anhydrous prussic acid, or rather less than four grains in the drachm, being the article (commonly designated "of Scheele's strength") as manufactured by some respectable houses in London. We understand that Messrs. William Allen and Co., by means of silver as a re-agent, have uniformly concentrated it to this degree since the year 1820, when Mr. Barry introduced the use of that metal, to determine and regulate its proportion of absolute prussic acid by the formation of cyanuret of silver. The method being one which admits of extreme precision, will deserve the attention of the College of Physicians, if prussic acid be inserted in the next Pharmacopœia. It is to be recollected that this preparation, like those of alcohol or ether, is subject to variation, notwithstanding any superiority of formula, or care on the part of the operator. Hence the necessity of means for assaying the final product, and for reducing it to a uniform standard. With regard to the employment of cyanuret of potassium for the occasional formation of hydrocyanic acid, it is a question which, at least, deserves serious consideration. Its disposition to absorb atmospheric moisture, and always to become more or less converted into carbonate, while its cyanogen (united to hydrogen,) to an uncertain extent is dissipated, especially when this beautiful salt is much disintegrated, constitute formidable difficulties. But a still greater objection will present itself at the counters of apothecaries and chemists where medicines are made up, from the possibility of this intensely poisonous salt being sometimes mistaken for other substances, in the frequent extemporaneous production of prussic acid.—*Lond. and Edinb. Phil. Mag. Feb.* 1834.

Composition and specific Gravity of different kinds of Glass, and true nature of that Substance in general. — Among the notes which have been added by Mr. Brayley to his new edition of Parkes's Chemical Catechism, quoted in a previous article, we find several which give a concise view of the present state of knowledge on certain subjects which are immediately within the scope of this department of the *Repertory*, and which, accordingly, we take leave to transfer to our pages. The first we shall select relates to the chemical history of glass, a subject which, until recently, has received little attention, notwithstanding the important applications of that substance.

Ordinary flint-glass, according to Mr. Faraday's analysis, consists, in 100 parts, of silica 51·93, oxide of lead 33·28, potash 13·77, with minute portions of other substances. A specimen of the same kind of glass, manufactured for telescopes by the late M. Guinand, yielded the same chemist, silica 44·3, oxide of lead 43·05, and potash 11·75. Mr. Faraday found the specific gravity of M. Guinand's glass to be about 3·616, that of ordinary flint-glass 3·290, that of plate-glass 2·5257, and that of crown glass 2·5448.

Glass has usually been considered, without much actual inquiry into the subject, to be strictly a chemical combination of its ingredients, and in all respects a very perfect artificial compound. This, however, is far from being the truth, as will appear from the following facts. That the alkali in common glass of all kinds is in a very imperfect state of combination, many circumstances concur to evince. For example, Mr. Griffiths has shown that if a small quantity either of flint-glass or of plate-glass be very finely pulverized in an agate mortar, then placed upon a piece of turmeric paper and moistened with a drop of pure water, strong indications of free alkali will be obtained; and that if the pulverization be very perfect the alkali can be detected in other kinds of glass, containing

far smaller quantities of it. This proves that in whatever state of combination the alkali may be, it is still subject to the action of moisture. That flint-glass is by no means a compound resulting from very strong chemical affinities, and that the oxide of lead which it contains is as imperfectly combined as the alkali, has been shown experimentally by Mr. Faraday, and also appears from the tarnish which is produced on its surface by exposure to sulphuretted vapours, owing to the combination of sulphur with the lead. Glass which has long been exposed to the weather, frequently exhibits a beautiful iridescent appearance, and is so far decayed, that it may be scratched with the nail. The glass of some bottles of wine which had lain in a wet cellar near the Bank of London upwards of 150 years, examined by Mr. Brande, was soft, and greatly corroded upon the surface, in consequence of the partial abstraction of its alkali. After reciting some of these facts, and others of a similar description, Mr. Faraday observes, "Glass may be considered rather as a solution of different substances one in another, than as a strong chemical compound; and it owes its power of resisting [chemical] agents generally to its perfectly compact state, and the existence of an insoluble and unchangeable film of silica or highly silicated matter upon its surface." See Mr. Faraday's Bakerian Lecture on the manufacture of glass for optical purposes; Phil. Trans. 1830, pp. 46-50.—*Parkes's Chemical Catechism, by Brayley*, p. 128, 127.

Preservation of Vegetable Substances in a Solution of Common Salt.—In the Transactions of the Linnean Society, vol. xvi, p. 761, is the following extract from a letter addressed to the Secretary, by William Cooke, Esq. on the Preservation of Vegetable Substances in a Solution of Common Salt:—

"On the 30th of October 1826, Mr. B. M. Forster brought to me a specimen of *Clavaria muscoides* of Sowerby, with a desire that I would preserve it in the same

that I preserve anatomical preparations, (*Vide* Med. and Phys. Journ. March 1816.) I put it into brine a little below saturation, suspending it by a delicate thread of silk, and closing the bottle by means of glass. Since that time it has remained in the solution, and with the exception of having become a little deeper in colour, it is unchanged. As spirits are not only expensive, but usually deprive plants of all colour, the discovery of a cheap and effectual solution for the preservation of plants is a desideratum."

Indelible Ink prepared from the recently discovered Metal, Vanadium.—The following account is given by Berzelius, of a new and almost indelible Ink, applicable to all common purposes, which he has prepared from the recently discovered metal, Vanadium. The vanadates of ammonia, that is the combinations of the acid, formed by this metal with oxygen, united to the alkali ammonia when mixed with infusion of galls, form a black liquid, which is the best writing ink that can be used. The quantity of salt necessary for a perfectly black ink is so small, that it will be not worth considering, when vanadium is more generally known. The writing obtained with this ink is perfectly black. Acids render it blue, but do not obliterate it like common writing ink; the alkalies when sufficiently diluted not to act upon the paper, do not dissolve it, and chlorine, which destroys the black colour, does not, however, efface the writing, even when water is afterwards suffered to run over it. In a word, if this ink is not perfectly indelible, it strongly resists reagents which instantly cause common ink to disappear; added to which it is blacker and flows better, because it consists of a solution, and not of a precipitate suspended in a solution of gum. It remains to be proved what the effects of time will be upon it.—*Parkes's Chemical Catechism, by Brayley*, p. 564.

Utility in Nature of the Earth Alumina in the form of Clay, in retaining subterranean Waters,

AND THROWING THEM UP AS SPRINGS, TO THE EARTH'S SURFACE.—The annexed view of this interesting subject is given by Mr. Brayley, in the Chemical Catechism, as already cited, p. 162.

The use of alumina in the form of clay in retaining, and, in many instances determining to the surface of the earth, the waters which are deposited from the atmosphere, and received by drainage into its depths, is so important in itself, and presents phænomena so curious and interesting, that it would be improper, in the actual state of geological information, to pass the subject over, without offering some additional remarks upon it. The following have been selected and arranged chiefly from the authorities given below.

In the whole machinery of springs and rivers, and the apparatus that is kept in action for their duration, through the instrumentality of a system of curiously constructed hills and valleys, receiving their supply *occasionally* from the rains of heaven, and treasuring it up in their everlasting storehouses, to be dispensed *perpetually* by thousands of never-failing fountains, we see a striking and important provision for the welfare of the human race, and one which is manifestly the result of prospective contrivance. Among numerous instances in which the use of strata of clay in preserving a supply of water for the purposes of human life is exemplified, we may cite the stratum termed by English geologists, the *London clay* (on account of its forming the general substratum of London and its vicinity), and the immediately subjacent [and in fact associated] formation called the *Plastic Clay*. To the retentive power of these strata, is owing the entire supply of well-water in London and its neighbourhood. The London clay is very dense in its texture, and the entire stratum, in this district, is also of great uniformity of constitution; it is, therefore, even as a whole, nearly impervious to water. The alluvium with which its surface is covered, consisting of loam, sand, gravel, &c. (which may almost always be seen when any

new ground in London is dug into, as in the excavations for sewers, &c.) is full of water, received from the rains and other atmospheric depositions, and retained in it by the impervious clay below. The quantity of remarkably limpid but somewhat hard water drawn from this alluvium alone, in the metropolis itself, is almost incredibly great. It supplies nearly all the public pumps, and also, by means of very shallow wells, many of the large distilleries and sugar-houses, and some of the breweries. The never-failing supply of *soft* water, however, afforded by some of the deep wells in the breweries, &c. of London, and by very many such wells on its northern and north-eastern sides, rises from the sands of the *Plastic Clay*, which lies beneath the London Clay [being in reality merely the lower portion of the same geological formation]. It is collected from the rains at many points in the hills surrounding the valley of London, where the sands of this formation rise to the surface, (reposing against the chalk, which is the next inferior formation,) and retained by the Plastic Clay itself. In the valley of London, therefore, we have two great repositories of water, one over the other, and the water in the one of a different quality from that in the other, which are thus preserved and their contents kept separate, by the property of impermeability to water possessed by alumina in the form of clay. To the same property is owing the fact, that the waters of the Thames are not mingled with those in the sands of the Plastic Clay, from which, in some places, they are not many feet distant, the bed of the river consisting of clay, and therefore retaining the water. The bed of the river and the water of the Plastic Clay are separated by so small a space on the eastern side of London, that had Mr. Brunel driven the Thames Tunnel at any lower level than that which it actually occupies, its execution would have been rendered impossible by the resistless flood of water which would have poured into the works from below. The skill and ingenuity, therefore, by which half the Tunnel has been actually executed, with

a flood of overwhelming power both above and below, is beyond all praise; while the fact that these floods are prevented from meeting and destroying the Tunnel, by a barrier consisting only of a few feet of clay, is as interesting as it is important. But there are circumstances in geology still more interesting than the foregoing, under which masses of clay occur, arresting the progress of subterranean waters. The component strata of a coal-field, or district occupied by the coal formation, such, for example, as those of Newcastle and Staffordshire, are divided into numerous insulated masses, or sheets of rock, of irregular form and area, not one of which is continuous in the same plane over any very large district, but each is separated from the mass or sheet next adjacent, by a fracture called by the miners *a fault*, usually filled by a natural dam of clay. An incalculable amount of water drains constantly from the surface of the surrounding country into the porous beds of gritstone, &c. which alternate with the strata of coal itself; but it is separated into comparatively small collections by this system of drainage, and on account of the impermeability of the clay, it very rarely happens that water on one side of a fault passes to water on the other, so as to form a continuous and abundant percolation in one direction. By this arrangement, the water which would otherwise have penetrated into the necessary excavations, in quantities insuperable even by the power of steam in its most improved application, is admitted only in such portions as, though yet very great, are within controul; and thus the *faults*, although they occasionally interrupt the progress of the collier at inconvenient positions, and sometimes terminate it suddenly, are rendered, in the main, by the impervious clay which occupies them, his greatest safeguard,—a safeguard, indeed, which is absolutely essential to his operations. Corresponding phœnomena are presented in the masses and strata of the primary and other rocks, of earlier formation than the coal strata; which are

similarly indispensable to the working of mines for metallic ores. Of these many examples occur in the tin and copper mines of Cornwall, which exhibit a series of natural dams, guarding the miner from inundation, by traversing the rocks in various directions, and intercepting all communication of water between that mass in which he is conducting his operations, and the adjacent masses on the other side of the dam. It sometimes happens in the progress of mining that a fault filled by one of these dams of clay is penetrated, either inadvertently, or by design, in the pursuit of ore; and the quantity of water which then pours into the works is not unfrequently so great as to put an entire stop to them, and cause the abandonment of the mine. By the further operation of these faults and their impervious contents, the water which is thus prevented from impeding the operations of the miner, is in innumerable instances rendered available for purposes of utility, by being thrown up to the surface of the earth in the form of a series of springs, along the line of the fault. "The appearance of springs along lines of fault," Mr. De La Beche observes, "is what we should expect; for not only do they act as main drains to the strata which they traverse, but as Artesian wells, producing the same effects as these artificial perforations. For supposing faults to be abundant, in countries where Artesian wells are now so valuable, such countries would possess an abundant supply of water, upon the same principle that these wells now act. Knowing, therefore, that faults are abundant on the surface of our planet, we may infer that no inconsiderable portion of water is conveyed by them to that surface."[a] It is not to be supposed, however, that all the effects which have been related in this note, are due to the presence of the clay alone; many of them depend, primarily, on the deposition of the strata and the direction and the obliquity, &c. of the faults by which they are intersected; but these circumstances would be of little or no avail to the necessary control

and direction of the subterranean waters for the safety and use of man, were it not for the walls or dams of clay so frequently occurring in the faults, and the impermeability of that material. Canals, aqueducts, and artificial reservoirs are often *puddled,* as it is called, or lined with clay, on the same account. Natural streams, and in the course of time artificial ones also, deposit a quantity of finely divided matter in the form of clay wherever they flow, and hence they are said, by engineers, to puddle their own beds.—Conybeare aud Phillips's Outlines, p. 34-36; Buckland's Inaugural Lecture on Geology, as quoted in ditto, p. lii. lv; De La Beche's Geological Manual, first edit. p. 399 [or third edit. p. 379].

On the Manufacture of Oil and Spirit Varnishes, Gold Lackers, Gold Size, &c. By J. Wilson Neil, 21, King's Cross, Battle Bridge.

[*Continued from our last, p.* 118.]

Supposing the roof and doors all complete, in the left-hand corner, against the back wall, dig out a foundation 4 feet by 4, and 2 feet below the intended level of the floor; level the mould of the foundation, lay a course of brick and mortar all over, taking care that where the ash-pit is to be, the bricks are good and well laid; then set out the ash-pit. Mark out the circumference of the pot-mouth upon the foundation, with 9 inches space all round between the walls and circumference of the pot. If the pot be 30 inches diameter at the mouth, begin the ash-pit, and raise it four courses of bricks high, and 9 inches thick all round the ash-pit, carefully filling up and treading in a solid foundation of earth, clay, or rubbish, level with the ash-pit; then lay on a piece of flat iron across the back of the ash-pit, and another strong piece in front, 2 feet 2 inches from the back, for the wrought-iron bars to lie on, which bars are to be 1¼ inches broad at top, and 2 inches broad and flat at the ends, so that

when laid close, there will be half an inch space between the bars. The bars to be 2 feet in length. The ash-pit being 16 inches wide, requires seven bars. When the bars are laid on, then set the door-frame and door: let the door be 1 foot wide by 9 inches high. Then build the fire-place over the bars three courses high, with good sound Welsh or Stourbridge bricks, levelling and enlarging the fire place on each side as it rises up, leaving a flue 8 inches broad by 6 inches high, slanting upwards to the right. Upon the third course of bricks lay another course of bricks with their inner and upper edges cut or chipped off, so that the pot can be placed on them in the centre, where it is to be well secured by carrying up the remaining work with common bricks, forming and carrying up the circular brick-work, also bringing the flue round in a spiral form, leaving it 5 inches wide and 7 inches high, taking care not to carry the flue too high up the pot-sides; for if too high, it will be in danger of being overheated some time, when the pot is not near full, and thereby setting fire to the contents. The last or finishing course of bricks ought to be laid in composition, with the inner ends under the flange of the pot-mouth, and with the outer ends a little raised upwards. This pot being complete, call it the set-pot (fig. 1), as is used for the purposes of boiling oil, gold-size, japan, and Brunswick black, &c.

Fig. 1

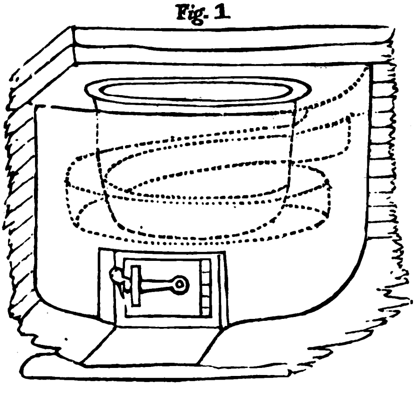
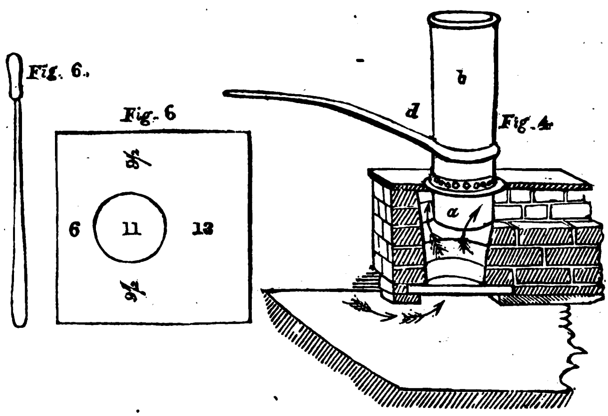


Fig 8

Fig 7

Boiling Furnace.

Dig out a foundation facing the front door against the back wall, 4 feet by 4, and 2 feet deep; lay one course of brick and mortar, as before; build up an ash-pit exactly as before, only leave a distance of 1 foot between the back-end of the ash-pit and the wall. When the pit is raised four bricks high, lay on seven bars, as before, placing the frame and door in front; then build a circular fire-place of 21 inches in diameter four bricks high, formed with the halves, or square ends of Welsh or Stourbridge bricks, well laid and close set: float the surface of the top course well, and have ready the cast-iron plate (see fig. 2); dimensions, 35 inches by 35, 1 inch thick, with a circular hole 17 inches diameter in the centre of the plate. A flue to be left at the back of the brick-work 8 inches wide by 6 inches high, into the chimney-shaft. Finish the ash-pit outside the furnace-door with a grating to fit, then it will be complete.



Gum-Furnace.

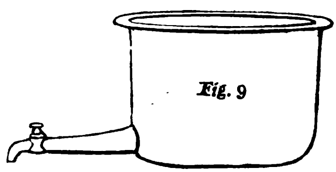
Against the back-wall, in the right-hand corner, dig out a foundation 3 feet by 3, and 2 feet deep; lay a course of brick and mortar; mark out and erect an ash-

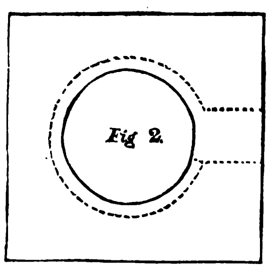
pit, the back of which is to be 16 inches from the back-wall, and 9 inches from the end-wall. The width of the ash-pit to be 16 inches by 28 in length; raise it five bricks high, carrying up the other part of the brick-work at the same time, 30 inches long by 37 inches breadth in front; then level all round, and tread in solid; lay a piece of flat iron at the back, and two pieces in front, to receive and rest the bars upon (seven in number), the same thickness as the others, only 13 inches extreme length, including 1¼ at each end made flat to the breadth of 2 inches: 9 inches clear of the brick-work lay the bars, and raise a circular fire-place 9 inches diameter inside, without any door or frame in front, only leaving the ash-pit open. Carry up 4-inch brick-work between the fire-place and the front with Welsh or Stourbridge brick-ends, set in loam round the fire-place; they must be laid close and solid, the outer ends of them well wedged. Above the third course leave a flue at the back 8 inches wide and 6 inches high, to communicate with the chimney-shaft. On the third course, above the bars, lay two more courses of brick, rather levelling or widening the furnace at the top. Have ready a plate cast on purpose, three-quarters of an inch thick, 30 inches long from back to front, and 30 inches wide, with a circular hole of 11 inches diameter, not in the centre of the plate, but only 6 inches from the front end (see fig. 3). Finish the perpendicular brick-work square with the edges of the plate, lay a moveable grating over the ash-pit in front, and it is complete. All furnaces require to have slow fires kept in them for a day, in order to dry them slowly, and prevent their cracking.

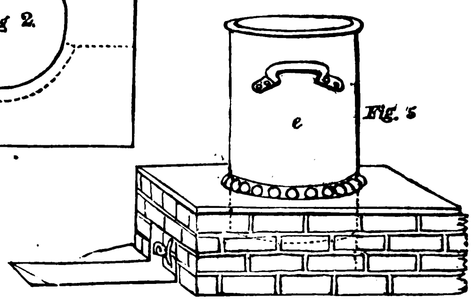
Gum-Pot.

Procure a copper gum-pot to fit into the last furnace, No. 3; the dimensions are 2 feet 9 inches high from bottom to top, 9½ inches diameter across the bottom outside. The bottom is hammered out of a solid block of copper, and fashioned, all of one piece, exactly like a hat

without a brim (see *a*, fig.4). The upper part of the pot *b*, is made of sheet-copper, of a cylindrical form, 10 inches diameter at top, and 2 feet 2 inches high, about three-eighths of an inch thick; the lower part of the cylinder is then rivetted to the bottom with copper rivets, the heads of which are inside, and project through the lappings of the copper, flattened on both sides. Previous to rivetting on the bottom, a flange of copper, of about three-eighths of an inch in thickness, is fixed on to the bottom part, under the large rivets: it is fixed horizontally round the pot. Also, previous to rivetting on the bottom, put on the iron hoop *d*, $1\frac{1}{2}$ inches in breadth, to which is welded an iron handle, made 1 inch broad by 1 inch thick, gradually increasing to 2 inches in breadth, but decreasing in thickness. The length from pot to handle end 2 feet 8 inches.







Boiling-Pot.

Procure a copper pot *e*, to fit furnace, fig. 5, the bottom

to be beat out of the solid, as the gum-pot, and of the following dimensions: Diameter across the bottom outside 20 inches; height of bottom 7 inches; the cylindrical or body part of the pot to be 2 feet 10 inches in depth, and joined to the bottom part with strong copper rivets, made to project through at least three-quarters of an inch, and to be well hammered inside and out; for, as there is no flange, the rivets must be large and strong to support the weight of the pot and its contents, while boiling on the furnace-plate. It ought to fit the plate neatly, yet so easy as to lift off freely. Seven inches below the mouth of the pot fix on two strong iron handles, one on each side, rivetted through each end with two strong rivets; the space for the hands to be 7 inches, and 1½ inches in diameter, and to project 4 inches from the pot sides.

Copper Ladles.

Two copper ladles, made to hold two quarts each, with the bowl part beat out of the solid copper, and rivetted to a rod of the same metal 3½ feet long, and three-quarters of an inch diameter, and finished with a turned hardwood handle 7 inches long, and rivetted at the end. Two good ladles for the iron set-pot, made of sheet copper or sheet-iron (cast iron being too heavy), with good ash-handles. For a pot of forty gallons, or upwards, the ladle to hold three quarts. Handle 5 feet long, tapering towards the hand.

Two copper-stirrers (fig. 6), made from three-quarter diameter copper rods, 3½ feet long, beat flat at the one end, to 1½ in breadth, 8 inches up the rod; to be finished with ferruled hands 7 inches in length.

One large, strong, well-made copper funnel, with lapped seams, for straining boiling varnish or oil (tin or soldered ones would melt).

One copper oil-jack (fig. 7), which will contain two gallons, for pouring in hot or boiling oil, with a large strong pitcher-fashioned handle, and spout in front.

One brass or copper sieve, containing sixty meshes to the inch, 9 inches diameter, for straining the first varnish.

One brass sieve, containing forty meshes to the inch, 9 inches diameter, for straining gold-size, turpentine, varnish, boiled oil, &c.

One brass sieve, forty meshes to the inch, and 9 inches diameter, for straining japan and Brunswick black.

One saddle (fig. 8), which is a sheet of plate-iron or tin, 12 inches broad, and turned up 1¼ inches at each side: it is to lie from the edge of No. 1 pot on the edge of the tunnel, to prevent the spilling of the varnish during the time of taking it out.

One tin pouring-pot, to hold three gallons, made exactly like a garden watering-pot, only smaller at the spout, and without any rose: this is never to be used for any purpose except pouring oil of turpentine into the varnish.

One three-gallon tin jack, made with a strong handle at back, and a large broad spout in front: used for receiving the washings when poured out from the gum-pot.

A small broom, termed a swish, made from the waste cuttings of cane tied on a small handle, like a hearth-broom, the head 5 inches long, and 5 inches round, with handle 3 feet long: its use is for washing out the gum-pot each time it is used; to be always kept clean, and left in oil of turpentine.

One iron trevet, made with a circular top 14 inches diameter, with four small cross bars; the three feet of the trevet 12 inches high: it is used for setting the gum-pot upon, with its bottom upwards, for a minute between each running.

[*To be continued.*]

ROYAL INSTITUTION.

Friday, February 14th.—Evening Meeting.

Dr. Faraday gave a conversation on Ericsson's Caloric Engine. He commenced by stating that he felt him-

self placed in a position of considerable difficulty in bringing forward a subject on which such difference of opinion existed; yet the objects of this institution was the philosophy of a question not to decide on the probable result in a mercantile point of view, of any invention or engine which might be brought forward, and in explaining the principles of Captain Ericsson's invention, he trusted that he should not be held responsible for the correctness of the various propositions which he would have to make; at the same time he was bound to state, that, prior to the construction of the engine, one part of the invention was submitted to his opinion, and he had reported favourably; and this was the possibility of transferring the heat contained in a current of air passing in one direction to another current of air passing in an opposite direction (separated only by metallic surfaces); but how far this might be usefully and economically employed in obtaining an engine of power, it was not for him to determine; this question would be brought to a fair test when an engine of 50 horse power, now constructing, shall be set to work. Dr. Faraday then described the manner of transferring heat from one current of air to another by working models, and afterwards, by the aid of working diagrams, he explained the construction of Captain Ericsson's engine. Our having given a full account of this engine at page 42 of the present vol., will render it unnecessary again to describe the principles on which this invention is proposed to work. Dr. Faraday having explained the various bearings of the question, concluded by observing that he was bound, in justice to his own character, to make a remark, which he regretted the more that it was possible and probable, had he been able to see Captain Ericsson prior to his entering into this explanation, he would have been able to remove a doubt and difficulty which he (Dr. Faraday) must confess he could not clear up to his satisfaction; this had been prevented by the serious illness of Captain Ericsson. What he referred to was, that he could not clearly see how the difference of

pressure, stated by the inventor to exist, could be maintained in the different parts of the apparatus.

Institution of Civil Engineers.

The following are the subjects which have been under discussion at the Tuesday Evening Meetings:

What are the advantages to be derived from the application of undulating Rail Roads.

After a full discussion (lasting two evenings), in which many of our best and most talented men took part, this question was dismissed with a general expression, that there were no advantages to be derived, but, on the contrary, a decided loss.

Heating power of Coal and other kinds of Fuel:—Have any experiments been made, or data collected, from which can be calculated the number of cubic feet of atmospheric air which one pound of good Newcastle coal will raise 1° of Fahrenheit?

This subject has called forward considerable information, but nothing final has been determined on; but so far as we are able to judge Tredgold's calculations may be depended on for their correctness.

Velocity of Currents of Air:—Is there any instrument for measuring correctly the velocity of air in motion; and if so, upon what principle does its action depend?

Mr. Barwise explained an instrument constructed by him for this purpose, and promised to construct one for the Institution.

The following are the subjects which stand next for discussion:—

Grouting Masonry and Brickwork:—The application of it—how and when it ought to be used—the materials for it.

The worm in the Timber of Piles, &c.:—Driven in salt water, and the means of preventing it.

Lock Gates and Sluices:—With any late improvements in the materials or construction.

Steam:—Any substitute for it—Ericsson's caloric engine.

CRITICAL NOTICES AND REVIEWS.

Tables for Calculating the Cubic Quantity of Earth-work in the Cuttings and Embankments of Canals, Railways, and Turnpike Roads. By John Macneill, Civil Engineer, &c. &c.: London, Roake and Varty.

Every one who has been engaged in extensive cuttings or excavations, and has felt the labour of making the various calculations of the quantities of earth to be removed, will fully appreciate the utility of the present work. In forming tables to aid calculation, the first inquiry should be, whether they are made on a correct foundation, and next, whether there is that general correctness as will warrant the confidence which is requisite to render tables of any description of general practical application to the purposes intended. Mr. Macneill is unquestionably right in proceeding on the prismoidal formular, and he has correctly pointed out the errors consequent on calculating the quantity of earth-work by other methods. In reviewing a work of this class it is not to be expected that we should pursue each particular item, in order to ascertain its correctness; all that can be expected is, that we should first satisfy ourselves as to the principles pursued in making the calculations, then by working a few propositions and comparing them with the tables, we may, in a great measure, arrive at a just estimate of the work. We have pursued this course, and the result is favourable to the correctness of the tables, for we have not met with an error.

This work has come out most opportunely when cuttings for railroads form a matter of such considerable attention as at the present time. Indeed, engineers will be saved much labour in making their calculations; for having surveyed the line of road or canal, and determined on the base and slope, the quantity of earth-work may be ascertained with the greatest rapidity. Mr. Macneill deserves the approbation of every engineer as well as con-

tractor engaged in forming roads, canals, or other extensive excavations or embankments, and we trust his tables will meet with the sale they unquestionably merit.

LIST OF NEW PATENTS.

William Thomas Yates, of John Street, Cambridge Heath, in the County of Middlesex, Engineer, for certain improvements in boilers for steam-engines and other uses. —Sealed January 23, 1834.—(*Six months.*)

William Garrod, of Davenham, in the County of Chester, Gentleman, for improvements in manufacturing salt.—Sealed January 25, 1834.—(*Six months.*)

Neil Arnott, of Bedford Square, in the County of Middlesex, Esq. for certain improvements on metallic pens and on penholders.—Sealed Jan. 25, 1834.—(*Six months.*)

Benjamin Hick, of Bolton-le-Moors, in the County of Lancaster, Engineer, for certain improvements in locomotive steam-carriages, parts of which improvements are applicable to ordinary carriages, and to steam-engines employed for other uses.—Sealed January 25, 1834.—(*Six months.*)

George Alexander Miller, of No. 179, Piccadilly, in the Parish of Saint James, Westminster, in the County of Middlesex, Wax-Chandler, for an improvement in lamps.—Sealed February 6, 1834.—(*Two months.*)

Benjamin Dobson, of Bolton-le-Moors, in the County of Lancaster, Machinist, and John Sulcliff and Richard Threlfall, both of the same place, Mechanics, for certain improvements in machinery for roving and spinning cotton and other fibrous materials.—Sealed February 6, 1834. —(*Four months.*)

Jacques Francois Victor Gerard, of Redmond's Row, Mile End, in the County of Middlesex, for certain improvements in the means of finishing silks, woollen cloths, stuffs, and other substances requiring heat and pressure. Communicated by a foreigner residing abroad. —Sealed February 8, 1834.—(*Six months.*)

William Stedman Gillett, of Guildford Street, in the County of Middlesex, Esq., for certain improvements in guns and other small arms.—Sealed February 8, 1834. —*(Six months.)*

William Marr, of No. 33, Bread Street, in the City of London, Ironmonger, for an improved method of making and manufacturing of all kinds of copper, iron, tin, and other metal safes and boxes and repositories, with metal and mineral, and other means so as to afford the most perfect security against fire to deeds, documents, and property contained therein.—Sealed February 13, 1834. —*(Six months.)*

Samuel Hall, of Basford, in the County of Nottingham, Cotton Manufacturer, for improvements in steam engines.—Sealed February 13, 1834.—*(Six months.)*

Thomas Griffiths, of Birmingham, in the County of Warwick, Tin Plate Worker, for an improvement in the manufacture of tea-kettles and other articles, now usually made of copper, copper tinned, or plated iron tinned, or any other metal or metals.—Sealed February 15, 1834.— *(Two months.)*

Miles Berry, of 66, Chancery Lane, in the Parish of St. Andrew, Holborn, in the County of Middlesex, Engineer and Mechanical Draftsman, for certain improvements in machinery or apparatus for shaping and forming metal into bolts, rivets, nails, and other articles, parts of which improvements are also applicable to other useful purposes. Communicated by a foreigner residing abroad. —Sealed February 19, 1834.—(*Four months.*)

James Smith, of Deanstone Works, in the Parish of Kilmadock, in the County of Perth, Cotton Spinner, for certain improvements in machinery used in the preparing and spinning of cotton, flax, wool, and other fibrous substances.—Sealed February 20, 1834.—(*Six months.*)

George Haden, of Trowbridge, in the County of Wilts, Engineer, for certain improvements in the machinery applicable to the manufacturing of woollen cloth.—Sealed February 24, 1834.—(*Two months.*)

THE

REPERTORY

OF

PATENT INVENTIONS.

No. IV. NEW SERIES.—APRIL, 1834.

Specification of the Patent granted to THOMAS PARSONS, *the younger, of Furnival's Inn, London, Gentleman, for certain Improvements in Locks for Doors and other Purposes.*—Sealed December 20, 1832.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Thomas Parsons, do hereby declare the nature of my said invention to consist, first, as regards door-locks, in an arrangement of lever-tumblers, carrying with them loose tumblers, in such manner that both the lever-tumblers and the loose tumblers act in retaining the bolt, as well in its locked as in its unlocked position; as also in an arrangement of lever-tumblers without loose tumblers, such lever-tumblers acting in notches on the bolt, as hereinafter explained. In both which cases, my said arrangement and form of tumblers and the springs, are such as to allow of the tumblers being made of very thin metal, so that I may have many of them in one lock, without increasing its size to an inconvenient thickness. And, secondly, as regards box-locks, in having two

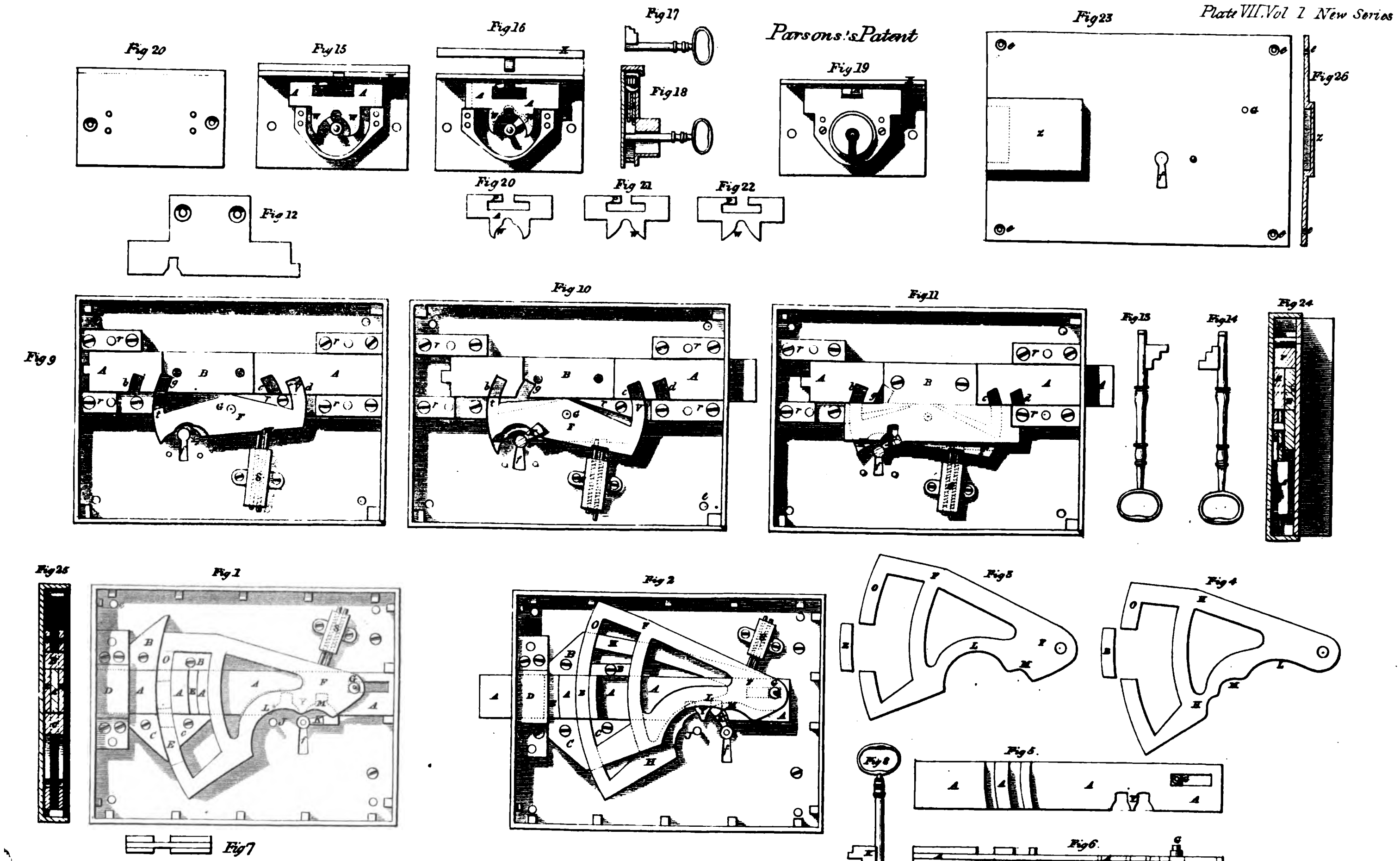
or more thin bolts to shoot at the same time, with the same key, without any tumbler; but so arranged, that the bolts do not require to be adjusted by the steps or rises of the key, before they can be thrown into the catch or keep, when locking; but do require to be so adjusted before they can be withdrawn from the catch or keep when it is to be relieved from them.

And, in further compliance with the said proviso, I, the said Thomas Parsons, do hereby describe the manner in which my said invention is to be performed, by the following statement thereof, reference being had to the drawing annexed, and to the figures and letters marked thereon (that is to say):

Description of the Drawing.

Figs. 1 and 2 represent a door-lock, with the front plate taken off to shew the internal parts: and it may be as well here to observe, that similar letters are used to denote similar parts in all the figures. A, A, A, A, A, is the bolt, on each side of which are formed two grooves or recesses, each in the form of the arc of a circle, as shewn in the edge-view of the bolt, at fig. 6. In these grooves the tumblers work, as hereinafter explained. B, B, and C, C, are two guides, one on each side of the bolt, and each made of five pieces, as shewn by the edge-view of the guides, at fig. 7, so as to form a groove or recess on each side, similar to, and corresponding with, the grooves in the bolt. These pieces are intended as guides for the tumblers, and not to guide the bolt, there being a clip, D, to guide the bolt. This clip, D, is fastened or held by four strong screws, which pass through the back plate of the lock into the door to hold the lock to its place. For the sake of clearness, I have only shewn two lever-tumblers in this figure, one on each side of the bolt; but it will be evident any convenient number may be applied equally well. The parts marked E, E, are two loose pieces of metal, which I call loose

Parsons's Patent



London . Simpkin & Marshall . for the Proprietor Apl 1 1834.

tumblers, one fitting and lying loosely in one of the grooves of the bolt, and the other partly in the groove in the bolt, and partly in the groove in the guide C; and there are two similar pieces, not seen in this figure, in the grooves at the underside of the bolt. So that for each lever-tumbler there are two loose tumblers; and these latter are carried to and fro with the bolt, when the bolt is put in action. The part marked F, shewn separately at fig. 3, is one of my lever-tumblers, centred upon a fulcrum at G. This fulcrum, or axis, passes into both the front and back plates of the lock, and carries both the lever-tumblers, one on each side of the bolt, as shewn at fig. 2, where the second tumbler is marked H. By this arrangement, both the lever-tumblers, it will be seen, act from the same axis, or centre. *e, e, e, e,* four screw-holes to receive the screws which pass through and fasten the front plate to the lock. *f,* the key-hole. K, the key, the pipe of which receives the key-pin fixed into the corresponding part of the front plate, but not seen here, by reason of the front plate being removed to shew the inside of the lock. It will be necessary here to observe, that in figs. 1 and 2, I have represented a lock requiring a pipe-key to open it; in consequence of which, when required to unlock, from either side of the door, it is necessary to have two key-pins, one in each lock-plate, and, consequently, two key-holes. In each of these figures only one key-hole, *f,* and one key-pin, J, will be seen. On the lever-tumbler, F, at L and M, are cut two curves for the key to act upon; one suited for the key to act upon through each key-hole.

Fig. 4, is the second, or, as shewn in this figure, the under tumbler, and is marked H; and, by comparing the two lever-tumblers with each other, it will be seen that the space to be occupied by the loose tumbler E, in each figure, is cut at a different part of the arc which forms the end of each tumbler.

Fig. 5, is a plan of the bolt, with the fulcrum, or axis,

of the lever-tumblers, shewn passing through a slot, cut in the bolt, precisely of the length required for the proper action of the bolt; the axis has a square formed on it, to fit the slot, of equal thickness with the bolt, and serves to steady that end of the bolt. The guide pieces B and C, should be made in five pieces, as shewn at fig. 7, if the bolt be placed in the middle between the two tumblers, as in the drawing, in order to afford the requisite facility for seeing the lower tumblers, while the manufacturer is adapting each to be correctly raised by the key; and they may be afterwards attached together by rivets, or by screws, as shewn in this figure, which screws also attach them to the back plate.

Fig. 8, is the key. Now it will be observed that each of the lever-tumblers has a space for the loose tumblers, cut from a different part of the arc O, so that when the lever-tumblers are pressed upon, in the direction of their line of motion, by the action of their respective springs at S, they will assume the position shewn in fig. 1, wherein they intercept the motion of the bolt which is unlocked; and thus it is evident each lever-tumbler must be raised to a height differing from the other, and each step in the bit of the key must be so proportioned to the lever-tumbler, on which it is to act, as to raise the loose tumbler E, entirely within the recess in the bolt, or otherwise the bolt cannot be moved by the key.

Fig. 2, is a plan of the lock with the bolt thrown out by the key, or locked, the lever-tumblers being so raised by it as to place the loose tumblers wholly within the recess in the bolt, which is consequently not impeded in its motion by the tumblers, but, on the continued motion of the key, the springs will again depress the lever-tumblers; and the loose tumblers, which these act upon, will be carried into the position shewn in fig. 1; and thus the bolt will be securely held by the tumblers, and prevented from being moved, excepting by the right key. S, is the case holding the springs which act upon the

lever-tumblers F and H. These springs are formed by a small shouldered pin or bolt, acting against a spiral spring, in a box or block pierced with as many holes as there are bolts or pins; one only can be seen in this view, but, as there are two tumblers, there must of course be two small bolts and springs; for, as in this arrangement, each of the tumblers rises a different height, each must have a separate spring to act upon it. For the sake of not confusing the drawing, and to render it more clear and simple, I have shewn only two tumblers; but a competent locksmith will be aware, that by reason of the peculiar support the tumblers receive from the guides B, B, and C, C, on each side of the bolt, more tumblers than have been heretofore may be introduced into any given thickness of a lock; and the number probably will be only dependant upon the practicability of constructing springs enough, in the given space, to act upon them. The workman will know how to add a spring-bolt and its appendages, if desired, as also to adapt this, like other tumbler-locks, to the several uses to which such locks are usually applied. This lock is more readily made with one key-hole, and two keys, as in the lock shewn at figs. 9, 10, 11, 12, 13, and 14, hereinafter described: for to construct it with one key only, unless one half of the number of tumblers be duplicates of, or formed like, each other, and arranged as is usual in Barron's locks, I believe it is requisite that the back plate of the lock should be removable, so that the workman may work from each side of the lock successively.

Fig. 23, is a plan of the outside of the front plate of the lock. Z, is a raised part to form a recess inside and lie over the clip, D, which necessarily projects to the extent of its thickness above the general service of the upper lever-tumbler, as shewn in the end view figure, 26.

Having now described the various parts of the lock, I

will proceed to explain its action. The lock being at the unlocking position, and the various parts at rest, as shewn at fig. 1; the key must be introduced, and, being turned in the proper direction, the short step of the key will raise the lever-tumbler F, until the loose tumbler E, is lifted into the forward recess on the front side of the bolt, while the long step of the key will raise the lever-tumbler H, until its loose tumbler is lifted into the corresponding recess or the back side of the bolt. At this moment the key will come in contact with the talon of the bolt marked Y, and throw it forwards, carrying with it the two loose tumblers, which have just been raised by the back and front lever-tumblers, and bringing the two loose tumblers, which have been lying inert in the two hinder recesses, forward, in order to be acted upon by the lever-tumblers, when the key is turned completely from under the lever-tumblers; and they then resume the position shewn in fig. 1, though the bolt will be in the position shewn at fig. 2, where the lever-tumblers are shewn raised by the key to the position required to let the bolt pass forward: and it will be seen, by examining this figure, that when the key is turned quite from under the lever-tumblers, in order to remove it, the lever-tumbler F, will force down the loose tumbler E, nearly out of the recess it is in, whilst the lever-tumbler H, will force its loose tumbler down also a little way, but not quite so far down as the tumbler F, the difference depending entirely on the different situations of the spaces cut in the front arcs of the lever-tumblers.

Figs. 9, 10, and 11, represent another door-lock, of a more simple form, and without any loose tumblers. The back plate is removed to shew the inside. A, the bolt, having four curved notches cut in its edge at *b*, *g*, *c*, and *d*, to admit the curved ends, which I call the teeth of the tumblers, and a recess, B, figs. 9 and 10, cut in it to admit the locking-plate shewn separately at fig. 12. *r*, *r*, *r*, *r*, *r*, five pieces of metal screwed to the front

plate of the lock, in part to steady one end of the bolt, but especially designed to support the tumblers. F, in figs. 9, 10, and 11, is the upper tumbler, having an arc of a circle projecting from each end, which I call a tooth; and H, is part of another tumbler, which may be seen lying immediately under F. G, in figs. 9, 10, and 11, is the fulcrum of the lever-tumblers, fixed into the front plate of the lock. S, figs. 9, 10, and 11, is a piece of metal containing a spiral spring for each tumbler, similar to that described in figs. 1 and 2, with two screws to fix it to the front plate of the lock. These springs keep the ends or teeth of the tumblers, in the notches in the edge of the bolt. *f*, fig. 9, is the key-hole for the two pin-keys; and K, fig. 10, is an end view of the bit of the key.

Fig. 9, is a plan of the locks, with the bolt drawn in, or unlocked, and the locking-plate removed to shew the tumblers, each of which is shewn by a dotted line, to have its arc or tooth differing in length from the other, and one end pressed by the springs into the bolt at *d*.

Fig. 10, is a plan of the lock with the bolt thrown out, and the tumblers withdrawn from the bolt by the key.

Fig. 11, is a plan shewing the locking-plate attached by two screws to the bolt, and fitting the recess B, shewn in figs. 9 and 10. The key is shewn as having raised the tumblers parallel with the edge of, and thrown out the bolt; and at the point where its farther motion will allow the springs to force the arcs or teeth of the tumblers into the notch of the bolt, when the bolt will be prevented being moved back again, excepting by the right key; as a key, not fitted to each tumbler, will either not release all the arcs or teeth at one end of the tumblers from the bolt, or force one or more of those at the other end into the corresponding notch of the bolt, which would equally prevent the withdrawing of the bolt.

Fig. 13, is the key for the outside; and

Fig. 14, that for the inside of the lock, and a short pin is fixed on each side of the key-hole on the front plate of the lock, as shewn in figs. 9, 10, and 11, to prevent the passage of the wrong key. Any capable locksmith knows how to add a spring-bolt and its appendages, and to adapt this invention to any other kind of lock; as also how to add as many tumblers as he may find it practicable to construct springs to act upon, making the arc or tooth of each to differ in length from all the others, that no two may have to be raised alike for the bolt to pass.

Having now described the various parts of this lock, which has no loose tumbler, I will proceed to explain its action.

Fig. 9, shews the lock at its unlocked position, the tooth V, of the tumbler F, being in the curved notch cut in the bolt at *d*, and thus holding the bolt fast, while the corresponding tooth of the tumbler H, is only as far in the notch as shewn by the dotted line. When the key is turned to throw the bolt forward to the locking position, it first acts upon the lever-tumblers, raising the tooth *t*, of the tumbler F, high enough to throw the tooth V, out of the notch *d*, and the tooth H, of the tumbler H, high enough to clear its tooth under V, in the same manner; and this will bring the tumblers to the position shewn at fig. 10, when all the teeth being clear of the notches, the bolt will pass forward by the action of the key: but it is obvious from this arrangement, that if a wrong key be used, even though the teeth at the foremost end of the tumblers were to be depressed sufficiently low to clear the *notches*, yet, if this be done in a degree the least too much, the teeth at the other end of the tumblers will at once rise into the notches *b*, or *g*, and effectually prevent any action of the bolt.

Figs. 15 and 16, represent a box-lock without a tumbler, with the back removed. A, A, is the bolt, under which there are two others. There is a groove in each

of the bolts, cut from the middle part towards each end, with the usual opening upwards, to receive the keep or catch; w, w, the talons for the key to act upon, and formed upon each bolt. At x, are three springs fixed under the upper part of the rim of the lock, and pressing against the bolts, which are all level on the top, to prevent the right key from overshooting them, as it might do without the springs.

Fig. 15, shews the lock in its locked state, one limb of each bolt having been moved by the key into the catch or keep of the lock.

Fig. 16, shews the lock unlocked, all the bolts being withdrawn from the catch or keep of the lock, which is removed as shewn; and the dotted lines in these two figures, shew the chief variations in the bolt next beneath the upper bolt, while the third or undermost bolt must be varied a little from both.

Figs. 20, 21, and 22, are separate views of these bolts.

Fig. 17, is the key with its steps adapted precisely to lock and unlock each bolt, the talons of each being varied from the others in such manner that the right key will throw the bolts, so that when unlocked the ends of all their limbs shall correspond with the opening in the upper rim or selvage of the lock.

Fig. 18, shews a section of the lock, with the key pressing against the bolts, and the ends of their limbs are seen within the catch.

Fig. 19, is a back view of the lock, with the back plate on; and

Fig. 20, a front view. Now an examination of figures 15 and 16, will shew that there is not any impediment to prevent any of the bolts from being pushed too far by the key; so that if any attempt be made to unlock the lock with a wrong key, it will either not push all the bolts far enough to unlock, or too far, in which case it will be relocked by the passing of the other limb within the catch or keep, thus answering the purpose of a tumbler-lock,

in a more simple and less costly form; and these bolts are equally applicable to a padlock, or any other which allows of the use of the same kind of catch or keep. Two bolts may answer, perhaps, for some locks, and to others more than three may be applied, if required, at the discretion of the locksmith.

Fig. 24, is a section of fig. 9; and

Fig. 25, is a section of fig. 1.

Now whereas I claim as my invention the form and arrangement of the several lever and loose tumblers, and guide-pieces here shewn, such being applicable to door and other locks; and also the hereinbefore described combination of several bolts, as likewise their peculiar shape with reference to the part marked P, in figs. 20, 21, and 22, acting together with the same turn of the key, and here shewn applied to box locks, but equally applicable to padlocks. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called England; his said dominion of Wales, or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained; wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled, June 20, 1833.

Specification of the Patent granted to WILLIAM AITKEN, *of Carron Vale, Scotland, Esquire, for certain Improvements in the means of Keeping or Preserving Beer, Ale, and other fermented Liquors.* — Sealed March 30, 1830.

To all to whom these presents shall come, &c. &c.—

Now know ye, that in compliance with the said proviso, I, the said William Aitken, do hereby describe the manner in which my said invention is to be performed, by the following description thereof (that is to say) :—

My improvements consist in particular means of preserving for use beer, ale, cyder, wine, or other fermented liquors. All such liquors contain in them quantities of carbonic acid, and of spirit or alcohol, which quickly escape from them whenever they are exposed to the air, and are freed from the pressure of a confining vessel; the first with the appearance of frothing; the second, invisibly; and it is usual, therefore, to preserve them in close casks perfectly filled, or in well corked bottles. The latter is the suitable mode when they are to be used in small quantities at a time, both because it allows a stronger pressure to be maintained on the liquor in proportion to the smallness of the containing vessel, and because it prevents the loss or deterioration, by escape, of the gas from any large quantity of the liquor that might be left unused at the time. Now any contrivance which, with other advantages, should save the great expense of bottling, by allowing brisk liquors to be kept in bulk, so that portions might at any time be taken away for use, without injury to the remainder, would be of great importance. This is the character of the new means which constitute my invention : were it possible to cause a cask or bottle to diminish when part of its contents were removed, so as to remain still full, and to compress the remainder as strongly as it originally compressed the whole, the end would be answered; and this may really be done by making the cask or vessel cylindrical, like a common pump barrel, with a close-fitting piston, to follow the remaining liquid, on any being drawn off, so as always to maintain the same pressure : but as there are many objections to such an apparatus, as of expense, difficulty of execution, &c., I obtain the same result by using common vessels, of unchangeable size, into which,

as liquid is withdrawn from them, I either force something of equal bulk with such liquid, or I use the carbonic acid gas generated in the liquid itself, so as to answer the purpose.

The following are my contrivances.

First, having a containing vessel, which is air-tight, with a syringe, or other suitable means, I force carbonic acid gas into it in bulk equal to the liquid at any time withdrawn through the cock. The carbonic acid gas is prepared before-hand in any of the cheap modes commonly in use, and is kept in an air-tight bag, or other convenient gas-holder. Second, where a sufficiency of carbonic acid gas is formed by continued fermentation in the liquor itself, instead of allowing it to escape, as is usually done, I retain it, guarding against too great an internal pressure, by adding to this form, as to the other forms of my apparatus, a safety-valve for the vessel. The valve may be kept closed by a spring or a weight, or other force, or it may be a liquid column, like that of the mercurial gauge of a steam-engine; or, in fine, it may be any convenient form of safety-valve. Third, or I produce the pressure by injecting, instead of carbonic acid gas, common or other air, which I, however, prevent from coming into contact with the liquid to injure it, by any suitable float on the surface of the liquor, or by making it enter into an air-tight bag, or sack, of suitable material (as that of which air-pillows are now made), previously introduced into the vessel. Fourth, or instead of forcing in air to press upon the liquor, I force in some liquid, as water, which is received into such a bag or sack as last described, and is thereby prevented from mixing with the precious liquor. Fifth, and instead of using a syringe, or pump, to inject the compressing fluid, I make it enter by the pressure of a liquid column, as when water descending to occupy a cask from which beer is being gradually drawn, comes from a reservoir above, by a pipe

of the height required to give the necessary pressure. Sixth, in open vessels, as in brewer's tuns, or store-vessels, I make the required pressure by a sack-bag, or heavy float, filled with water or other liquid, and resting on the surface of the fermented liquor. Seventh, when I desire to know and to regulate exactly the pressure in any vessel, I use a small gauge, as that employed by engineers or experimenters in their air-condensing apparatus. Eighth, while liquor is passing from one vessel to another from the brewer's tun, for instance, to the jar or vessel of the consumer, I keep up any desired pressure upon it by first injecting fluid into the smaller vessel, and, then making the liquor entering from one vessel to the other by a connecting-pipe, force it out again. Ninth, to strengthen, when necessary, my containing-vessel, whether of wood, stone-ware, or other material, I enclose it in an outer-vessel or case of cast iron, or other fit material, and I fill the interval between the two with some fluid strongly forced in. Tenth, in cases where it is desirable to remove from the liquor the sediment which falls during its standing, and which may afterwards favour the occurrence of the acetous fermentation, or of any other destructive change, I use a vessel of shape which may collect as much as possible of the sediment at one point of its bottom—a vessel, for instance, with a conical or funnel-shaped bottom, and I place a cock at that point by which, from time to time, the sediment may be withdrawn.

From the adoption of these means I anticipate a vastly increased use of fermented liquors, particularly of beer and ale; for draught liquors will thereby be rendered at least as good as those which are bottled, and besides great saving of expense, there will be many remarkable conveniences.

In describing the several parts of my aforesaid invention and improvements, I have purposely avoided the statement of exact forms or dimensions, because they

must vary with the circumstances in which they are used, and my invention does not consist in the particular forms or proportions of the things described, but in the new combination and arrangement of parts, most of which are already well known, for the production of new and beneficial purposes, to which such things have not been so employed before, or at any rate, not in so efficient and beneficial a manner; and I accordingly claim, as mine, the arrangements and inventions hereinbefore described and now alluded to.—In witness whereof, &c.

Enrolled September 30, 1830.

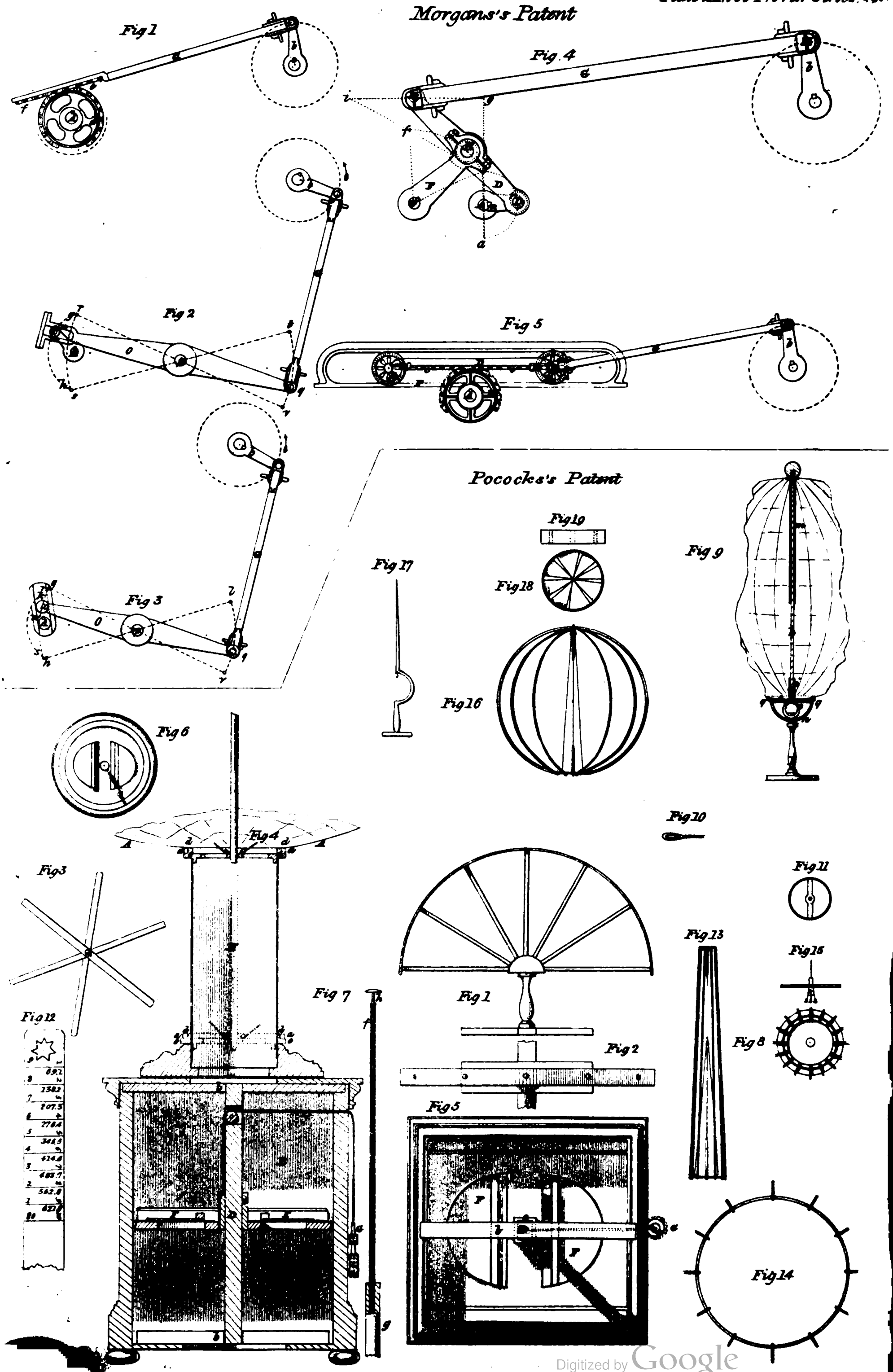
Specification of the Patent granted to WILLAM MORGAN, *of York Terrace, Regent's Park, in the County of Middlesex, Esquire, for certain Improvements in Steam Engines.*—Sealed February 14, 1831.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said William Morgan, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):—

My invention consists in the application of certain arrangements or combinations of apparatus for producing rotatory motion from the axis of a semi-rotatory steam-engine, or from the axis of a steam-engine, the piston of which does not make a complete revolution, but oscillates within the cylinder.

In order that my invention may be clearly understood and carried into effect, I will describe the drawings hereunto annexed; but first observing, that my improvements relate more particularly to that description of engine described and shewn in a specification to a patent granted



London. Simpkin & Marshall, for the Proprietors Apl 1. 1834.

to Elijah Galloway, July 2, 1829, to which a specification was duly enrolled, such patent having been assigned to me by the said Elijah Galloway.

Description of the Drawing.

Fig. 1, represents one method of producing rotatory motion from the axis of a piston which oscillates but one-half of a circle, A, being the axis of the piston, which passes through the cover at one end of the steam-cylinder, and is packed in the usual manner for making it steam-tight. On the axis, A, there is a drum, *d*, so that when the piston is actuated and forced from side to side, it will carry with it the wheel or drum *d*, and by means of chains or straps, *e*, *f*, which are affixed to the wheel or drum *d*, and to the connecting-rod G, the connecting-rod G, will be drawn backwards and forwards, and thus will a rotatory motion be given to the crank *b*, and the same result will be produced by making the drum or wheel *d*, a toothed wheel; and having a rack cut or formed on the connecting-rod G, whereby the teeth of the wheel *d*, taking into the rack, will cause such rack and connecting-rod to be drawn backwards and forwards, and thus give rotatory motion to the crank *b*.

Fig. 2, is an arrangement of parts of apparatus to produce a rotatory motion from the axis A, of a semi-rotatory steam-engine. *o*, is a beam having its fulcrum at *p*, a semi-rotatory motion being produced to the arm *k*, affixed to the axis A, and by the friction-roller *a*, running between the guide-rods, *n*, *n*, formed on the end of the beam *o*, will cause the beam *o*, to vibrate from *r* to *s*, at the time the arm *k*, is performing the arc *g* to *h*, and the connecting-rod G, being attached to the other end of the beam *o*, the crank *b*, will be driven half a revolution by the end *q*, of the beam *o*, passing from *v* to *t*, and by the return of the arm *k*, from *h* to *g*, and the end *q*, passing from *t* to *v*, the revolution of the crank *b*, will be completed in the direction of the arrow.

Fig. 3, represents another arrangement, in which figure the same letters indicate similar parts to those in fig. 2, and the only difference in this arrangement from that described in fig. 2, is, that on the arm *k*, there is a groove cut, and the two sides, *n*, *n*, form guides for the friction-roller *x*, which friction-roller *x*, in this instance, is affixed (but allowed to turn) to one end of the beam *o*; and when a semi-rotatory motion is given to the arm *k*, by the axis A, of the piston, in the direction from *g* to *h*, the friction-roller *x*, will perform the arc from *r* to *s*, which will elevate the end *q*, of the beam to the point *t*, which will drive the crank *b*, one-half of a revolution, and by the return of the arm *k*, from *h* to *g*, the friction-roller will be carried back to the point *r*, and the end *q*, of the beam *o*, will be brought to the point *v*, which will cause the crank *b*, to complete the revolution in the direction of the arrow.

Fig. 4, shews another arrangement or combination of parts of apparatus for producing rotatory motion from the axis A, of the piston of a steam-engine, which makes about one-half of a revolution; B, being an arm affixed to the axis A, of the piston, by keying in the usual manner. D, is a beam connected to the arm B, by brasses and wedges to the axis or pin I, affixed to arm B. F, is an arm affixed on the axis or pin G, by a key, which axis or pin G, is affixed to, but allowed to turn in, the framing of the engine; or the arm F, may turn on a pin affixed to the framing. The beam D, is carried by the arm F, by the axis or fulcrum E, and to the end H, of the beam D. The connecting-rod G, is attached by the strap, brasses, and wedges in the usual manner; and the other end K, of the connecting-rod G, is attached to the crank *b*, as is represented in the drawing. When motion is given to the arm B, on the axis A, of the piston, it will perform the arc from *a* to *d*, which will cause the arm F, to make a partial turn by its axis G, and pass through the arc from *c* to *f*, which will carry

the connecting-rod G, from *g* to *i*, which is nearly in a right line, as indicated by dotted lines. By which motion the crank *b*, will perform half a revolution; and by the return-stroke of the engine the parts will be brought back into the points from which they started, which will drive the crank *b*, the other half of a revolution.

Fig. 5, shews another arrangement or combination for producing rotatory motion to the crank *b*. G, being a connecting-rod attached to the crank, as shewn at K, and at the other end to the axis of one of the wheels E, the wheels E, being connnected together by the bar or framing D, and the wheels E, run within the straight edges F, which are affixed to the framing of the engine. A, is the axis of the piston. B, a drum-wheel, having chains affixed on each side and to the bar D, as shewn in the drawing; or this wheel B, may have teeth formed around it, and the bar D, have a back affixed or formed thereon, so that when the wheel or drum B, be turned, first in one direction and then in another, by the axis A, it will cause the wheels E, to be drawn backwards and forwards; and they will be guided and kept in a right line by the straight edges or guides F, by which means the connecting-rod G, will produce rotatory motion to the crank *b*, at each backward and forward motion of the wheel B.

Having now described the nature of my improvements, and the manner of their action, I would have it understood, that, although I have here described my invention as applied only to the axis of a piston which makes a half revolution, yet I do not confine myself to that quantity of motion, as it will be evident, that in case a less quantity of motion be performed by the piston and its axis, by my improvements such motion will be readily adapted to the producing rotatory motion to the crank *b*, for it will only be necessary to cause the parts affixed to the axis A, of the piston, to pass through such a length as will cause the connecting-rods G, to move a length equal

to half the circumference of the circle through which the crank has to pass; and when the length of motion of the piston is greater than half a revolution, the same end may be accomplished; thus, when the motion is less than half a revolution, then it will be necessary to lengthen the space through which the parts attached to the axis A, have to pass, by which means a motion equal to the distance from *g* to *h*, in all the figures, may be obtained; or, by decreasing the size of the crank, the same result will be produced: and in case of a greater length of motion being given to the piston and its axis A, then it will be necessary either to shorten the length of motion of the parts attached to the axis, or to increase the size of the crank.

I have not thought it necessary to describe or to represent a steam-engine, it forming no part of my invention, and the construction thereof being well understood by engineers, and one which performs a greater length of motion than half a revolution, is also represented in the specification of the said Elijah Galloway.

I would observe, that although I have herein described parts which are separately well known and in use, yet I do not hereby claim the use of them, except when applied or employed to produce the object of my invention; and what I do claim, is, the application of the combinations described and represented, to the particular purpose of producing a rotatory motion from the axis of a piston, oscillating within a steam-cylinder, but such piston not making a complete revolution, whether such combinations be applied to the engine shewn in the specification of the said Elijah Galloway, or any other engine of a similar construction, that is, with a piston making only a partial revolution.—In witness whereof, &c.

Enrolled August 13, 1831.

Specification of the Patent granted to George Pocock, *of Bristol, Gentleman, for Improvements in Making and constructing Globes for Astronomical, Geographical, or other purposes.*—Sealed February 4, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said George Pocock, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained as follows (that is to say):

The great inconvenience that is experienced by the want of portability in globes used for illustrating the sciences of geography and astronomy, has prevented many persons from having them in their apartments, because when they are not in use they are incapable, from the nature of their construction, of being packed up so as in any way to reduce them in point of size. But the globes I have invented are constructed of paper, fine linen, silk, or any suitable flexible substance or material; which, being cut or formed into properly shaped gores, may be inflated with air, after they are pasted or united together; in which state, they may be sufficiently distended to assume a globular form, and be fit to explain the various useful problems usually taught by the assistance of terrestrial and celestial globes of the ordinary construction. Globes of this description may also be distended by the application of ribs, united and acting in a similar way to those used in umbrellas; and in either case the air can be pressed out, and the flexible materials of which they are constructed, may be folded up; and in that state they will be so portable that a globe four feet diameter may be very conveniently placed within the crown of an ordinary hat, the weight of a single globe being not more than four ounces. The flexible mate-

rials of which these globes are constructed, may be printed either from copper-plates, wooden blocks, or lithographic stone; but each gore must have a margin at least one quarter of an inch broad, which is necessary to paste them together, the gores being made to overlap each other that quantity, when pasted together. This mode of uniting them serves to strengthen the whole globe, the parts that overlap forming so many meridianal bands of support, when the globe is inflated or distended. Each globe which is to be distended by inflation, has an orifice of about seven inches diameter at the south pole, which is pasted round a light wooden hoop: this hoop serves to hold it by when it is to be inflated: it also forms a kind of stand for the globe to rest upon when it is placed upon a carpet or table; the hoop projecting, enables the carpet to act as a valve, and prevent the escape of the air. As the mode of uniting the gores together requires some care, I shall now explain the method I adopt, and also the kind of frame which I use to facilitate that object.

Description of the Drawing.

Fig. 1, in the drawing, represents a front-elevation of a wooden hoop about four inches broad: it is retained in a semi-circular form by spokes, which are made fast to it, and also the nave in the centre. The nave is made fast to a strong stem or pillar, the bottom of which is fixed in a cross-frame or stand. The outer-surface of the hoop is covered smoothly with woollen cloth, that the pasted portions of the gores may be smoothed and pressed by a hot iron. The diameter of this hoop should correspond with the diameter of the globe that is to be pasted upon it.

Fig. 2, represents a plan, or bird's-eye view of fig. 1. The gores may be joined or united in the following manner: the margin on one side of the first gore must be cut off close to the line of the meridian, and the margin that extends beyond the meridian of the adjoining gore must

be pasted and laid very smoothly on the hoop or frame, and then the part of the gore that has had the margin cut off must be laid upon it, taking great care that the meridian-line on each gore may be so placed that the upper one may exactly cover the lower one; and also that those countries, rivers, or parts that are cut by the separation of the gores, may be made to coincide, and the various lines made to meet in the most perfect manner. This being done, the pasted parts must be smoothed and dried with a hot iron; and each succeeding gore being joined by the same means, the whole will form a map, which, being inflated, will assume a globular form, so extensive as to admit the insertion of many particulars necessarily omitted on globes of the ordinary constructions and dimensions. It may be necessary to observe, that in forming the last joint, the joining or seam that forms the antipodes to the last joint must be laid upon the hoop or frame, and the last joining must be effected immediately over it, the ironing and every other operation being the same at the north pole, a circular cap of twenty degrees diameter is pasted on the globe, upon which is printed the mariner's compass, the signs of the zodiac, the months of the year, and the hour-dial. Immediately under, and concentric with this cap, three pieces of tape, about one foot long, are placed within the globe, the ends, for about two inches long, being pasted thereto, crossing each other in such a manner as to form six radial bands, which will correspond, and must be fastened by pasting to six of the meridianal joinings of the gores: the centre of these radial tapes is placed exactly under the centre of the north pole, and on the exterior point a small ivory knob or stud is fixed by being sewed to the centre of the tapes which serves as a north polar point and also as a handle to lift the globe by, when it is to be inflated; and as it is necessary to work many of the problems on these globes with a flexible scale, the ivory knob or stud serves as a fixed projecting point to suspend or attach one

end of a flexible scale to, there being a loop formed on one end of the scale for that purpose. A plan of the tapes and ivory knob will be seen at fig. 3. The last operation is that of finishing the orifice of the lower part, or south pole of the globe: this is done by pasting the edge of the orifice or opening of the paper gores to a light thin hoop of cane, about one-fourth of an inch diameter; the hoop being about seven inches diameter. After the edge of the paper or any other flexible material is fixed to the hoop by paste; a strip of thin cotton or linen is pasted over the hoop, and a portion extending beyond the hoop, about an inch and a half broad, is notched or vandycked, and this being pasted on the outside of the globe, around the orifice, serves to strengthen it at the part where it is united to the hoop. A section of the hoop and a fragment of the globe may be seen at *a*, A, *a*, in the upper part of fig. 4. Several methods may be adopted for inflating globes of this description; the most simple is that of laying hold of the hoop with one hand, and by moving it rather quickly, in an horizonal direction, the air will rush in at the orifice, and spread open the folds, the globe retaining a fresh quantity at each effort; and when it is about a quarter filled by this means, the hoop of the orifice must be placed on a carpet, or any woollen cloth laid smoothly on the floor, and then the ivory knob must be laid hold of, and the case must be lifted about eighteen inches or two feet from the floor, and then let fall rather suddenly (the ivory knob being firmly held between the fingers during the whole time the inflation is being completed), when it will be found, that by this sort of pumping motion the globe will be completely inflated. When these globes are not wanted for use, the air may be pressed out, and they may be folded first in plaits in the direction of the meridian lines, forming a number of double leaves, and when laid smoothly in that manner, they may be doubled or folded up so as to occupy no larger surface than the hoop. A second mode of in-

flation is by a simple air-condensing pump or box, which may be seen in figs. 4 and 5.

Fig. 4, represents a vertical section of a simple air-condensing pump or box. B, B, represents the principal chamber, having an opening for the admission of air at C. D, is an upright guiding-rod fixed to the two cross bars *b*, *b*, these bars being made fast to the sides of the box B. *c*, represents the socket of the piston E, which fits and moves upon the guiding-rod D. F, F, are two wings or clacks of a butterfly valve, which open and admit air to pass through them when the piston descends, but when it ascends they close and enable the piston to condense and force up air into the globe, as will be shewn hereafter.

Fig. 6, represents a plan or bird's-eye view of a small circular butterfly valve, which may be placed in the cover of the air-condensing pump, in the place and position shewn by dotted lines at *e*, *e*; and if the hoop of the globe is pressed upon the outer ring seen at *d*, *d*, upon which it should be made to fit air-tight, the globe may very soon be inflated by working the piston E, which may be done by using the hand-pull seen at G. Should a greater elevation of the globe at any time be necessary, the tin tube or hollow pillar H, must be fixed in the manner seen in fig. 4, and the valve-plate or frame *e*, *e*, that closes the orifice must be placed on the top of the tube H, as shewn in this figure; and when the globe is inflated, the globe pillar and stand may be removed to any convenient place to work any problem or explain its various uses.

Fig. 7. *f*, represents a vertical section of a small tin tube, the lower end is made to enter a hole in the wooden rod *g*, (the lower part of which is broken off), where it is made fast by binding the end of the rod with waxed thread or twine. *h*, represents a small wire stem, which is placed within the tube *h*, and works up and down freely within it. Upon the upper end is formed a button which is made to enter a corresponding eyelet-hole made in a piece of tape fastened immediately under the north

polar point of the globe, there being another piece of tape or linen fixed immediately above it, and against which the broad or upper surface of the button forms a bearing: this apparatus is used to steady the globe, when it is inflated by the air-condensing pump; the mode of applying it is as follows: when the globe is to be inflated, the button-hole fixed under the north polar point is to be brought down to the orifice, and the button upon the end of the wire stem *h*, is to be placed in the eyelet-hole, and then the bottom end of the wooden rod is forced very tightly into a hole made for it in the centre of the circular valve, and in that state, the hoop at the orifice being pressed closely on the ring of the valve, the globe may be inflated, and when the north polar point is elevated, the wire stem *h*, will slide up the tin tube, still keeping the whole steady, and preventing it from inclining either way from the perpendicular. Another mode of distending these globes, is, by the means of ribs in a very similar manner to that adopted in umbrellas: the ribs may be made of cane, whalebone, or any suitable elastic material or substance, that will be sufficiently light and strong enough for the purpose. The method of constructing the ribs, and combining them, is as follows:

Fig. 8, represents a brass plate having a deep groove made on the edge, in the same manner as the rib-plate of an umbrella. There are twelve notches or recesses made at equal distances round the circumference, for the upper ends of the ribs to move in, a wire being passed through the whole, and laying in the groove formed on the edge. Two such plates are used, one at the south pole, and one at the north. The lower, or south pole rib-plate, has a metal tube seven inches long, fixed to it, as seen in fig. 9, at *i;* in the upper part of this tube a taper wooden rod, *k*, is firmly fixed, being made to enter it about three inches. This rod is about three feet six inches long, and at its upper end a metal screw, *l*, is fixed, which is made to pass through a hole in the centre of the north pole rib-

plate, far enough to have an ivory or metal knob screwed upon it, in the manner to be described hereafter. The upper or north pole rib-plate has a similar tube, *m*, fixed to it, but it is two feet four inches long. This tube slides over the wooden rod *k*, when the ribs are expanded to distend the globe. The ribs are formed of light thin whalebone, cane, or any other flexible material, each end being formed into a loop, through which a wire passes to bind them to the rib-plate, the end being bent so as to form a loop, is secured by waxed thread: one of these is shewn broken off from the rib, at fig. 10.

Fig. 9. *n*, represents a brass semi-circle, each quadrant being divided into ninety degrees. The bar *o*, attached thereto, has a brass stem, four inches long, proceeding from its centre, which enters the lower part of the tube *i*; and upon this stem the globe may be turned round as upon a pivot. The brass arc *n*, is supported on a centre fixed on the upper part of the metal circle *p*, and by this means the axis of the globe may be placed at any angle and retained in that position by a clamping screw attached to the bar supporting the circle *p*, in the centre of which circle is placed the mariner's compass. The whole is fixed on the pillar of the stand I. When flexible globes of this description are distended by ribs, each joining or seam of the gores must have three loops of tape pasted to them, one exactly in the centre on the equator, and the others about half-way between that and the north and south poles. These loops must be attached before the last seam is completed, and when the last seam or joint is finished, the loops that are to be attached to it must be done by bringing the parts down to the orifice, where they must be added; the ribs must then be combined to the south pole rib-plate at one end, and the other ends must be passed up through the loops; and when that is done, they must be combined with the north pole rib-plate, by passing a wire through the whole, which will lay in the groove of the rib-plate. Care must also be

taken that the wooden spindle or rod *k*, be made to enter the metal tube *m*, fixed to the north pole rib-plate; and when it is once in its place, it will remain there without any derangement. If the north pole rib-plate be now pressed upon the upper tin or metal, tube *m*, will slide down the wooden rod or spindle, and the ribs will be expanded, which will distend the globe; and as the screwed end of the rod or spindle will protrude above the north pole rib-plate the ivory or metal knob may be screwed on it, which will retain it in the distended state similar to fig. 11. The printed cap containing the signs of the zodiac, the hour circle, &c., before named, must be joined to the globe by pasting, which will complete the operation at the north pole. At the south pole an orifice is left about seven inches diameter, which is strengthened at the edge by a fine endless cord, over which the edges of the paper are pasted. A metal circle or hoop, eight inches diameter, and about one inch and a half broad, having a bar fixed across the centre, with a hole in it, is placed upon the brass stem of the divided arc *n*. A section of this may be seen at *q*, *q*, and a plan of the same in fig. 11. This circle has a covering of paper pasted or cemented to it, upon which is printed the signs of the zodiac, &c., the same as are given on the cap of the north pole.

I now proceed to describe a flexible scale, made of tape, having paper pasted the whole length upon it on one side; the length is exactly six feet, corresponding to half the circumference of a globe of twelve feet circumference. It is divided into two equal parts, each part is divided into ninety degrees north and south from the equator; these degrees are maked on the left-hand edge of the scale, and is a substitute for the brazen meridian of ordinary globes. On the right-hand edge of the scale are marked one hundred and eighty degrees continuously, beginning from the north end of the scale. Under every degree is placed the number of miles. This part of the

scale is a substitute for the usual quadrant of altitudes, by which great dispatch is obtained in the measurement of distances. On the opposite side of the tape is an analemma, printed on paper in a similar manner to the scale described. A small portion of this scale, the real size, shewing the eyelet-hole that is placed on the ivory knob at the north polar point, is shewn in fig. 12.

My next object is to explain the method I adopt to make globes of this description revolving transparencies, and when illuminated by a light placed within them, they serve the useful purpose of a lamp, and at the same time by presenting the various heavenly bodies or divisions of the earth alternately to view, will have the effect of impressing these subjects upon the minds of young persons, effecting thereby two valuable purposes at the same time, namely, instruction and illumination, affording a pleasant medium light.

Fig. 13, represents the ribs of a revolving globe, united at the upper end to a rib-plate, as before described, the lower ends of the ribs being attached to a hoop or ring of cane, upon which they move. A plan of the hoop is seen at fig. 14, with portions of the ribs attached and a similar view of the rib-plate; and portions of ribs united is shewn at fig. 8.

Fig. 15. *r*, is a small metal cone, having three brass wires fixed to it, as seen at *s*, *s*, *s*, the lower parts being broken off, the lower ends of these are hooked at equal distances to the hoop, fig. 14. On the upper end of the cone a piece of metal extends, which has a hole made through it to attach a string or piece of fine wire to, in order that it may be drawn up and enter a hole formed in the centre of the rib-plate; and when in that state, a small pin is passed through the hole, which retains it stationary, and the ribs then assume the extended form shewn in fig. 16. An elevation of the cone, and portions of three wires, shewing the position of the cone when

attached to the rib-plate, is shewn on a scale the real size of the objects in fig. 8.

Fig. 17, represents an iron stem or spindle fixed in a stand; the upper end of this is pointed to enter the cone acting as a pivot for the globe to revolve upon; the bent portion in the spindle is made to contain a lamp, which hangs upon a hook attached to the upper part of the curve. The upper part of these globes have an orifice, about seven inches diameter, upon which is placed, concentrically, the pasteboard hoop, fig. 18, of the same diameter; and just within this is laid the vane, fig. 19. When the globe is suspended upon the stem, fig. 17, and the lamp lighted and hung on the hook of the spindle, fig. 17, the rarefied current of air will strike the vane and cause the globe to revolve as long as the lamp continues to burn.

The flexible materials used for the celestial globes of this description, are furnished with four plain eye-glasses, inserted in the southern hemisphere, at the lower part. These glasses are circular, and about an inch and half diameter; for the insertion of these, holes are cut in the globe, something smaller than the glasses, and then the glasses are pasted on the margin of the holes, and over them a circular piece of the same materials as the globe is laid of two inches diameter, having a hole in the middle of one inch diameter. These glasses may be used plain, or they may be made of glass stained of an orange-colour, which will have the effect of giving a very luminous appearance. The ground of these globes, or space between the stars, is coloured of a deep blue; the stars being white, will be transparent: if the eye of the spectator be applied to either glass the heavenly bodies will be exposed to view in their natural and relative situations.

Any of these globes (that is to say), either terrestrial or celestial may be made of any required dimensions, pro-

vided the proportions be kept the same as herein given: and I shall also observe, that the paper most suitable for making these kind of globes with, is that manufactured of new Irish linen, great strength being a very essential quality.

And I hereby further declare, that my invention consists of, firstly, in the application of ribs, as above described, for the purpose of distending flexible globes, which, being combined and applied in the way I have described, will distend, at pleasure, globes of this kind, and render them fit to work the ordinary problems upon, and when not in use they may be collapsed so as to occupy a very small space, in which state they will be found very portable. Secondly, I claim as my invention the application of a flexible scale when applied to these kind of globes, which scale will be found a substitute for the brazen meridian, and also the quadrant of altitude; by the use of which the measurement of distances and other problems will be greatly facilitated when it is applied to globes of this description. Thirdly, I claim the peculiar method, as above described, of making globes of this description revolve, by the application of which, in the way described, they may be illuminated and serve the useful purpose of a lamp, and by presenting the various objects printed or delineated upon them, they will assist in impressing them upon the memory, at the same time that they afford a soft and pleasing light. Fourthly, I claim the application of a divided semicircle and mariner's compass, when combined with flexible globes of this description, by the use of which the axis of the globes may be placed at various angles with the horizon, the compass serving the same purpose as in globes of the ordinary construction. And I also claim the application of a circle upon which is represented the signs of the zodiac, months of the year, and hour circle, which being placed round the orifice of the south pole, the solution of various pro-

blems may be thereby obtained.—In witness whereof, &c.

Enrolled April 3, 1830.

Specification of the Patent granted to Charles Terry, *of Shoe Lane, in the City of London, Merchant, and* William Parker, *of New Gravel Lane, Shadwell, in the County of Middlesex, Merchant, for Improvements in Making and in Refining Sugar.*—Sealed June 26, 1833.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, We, the said Charles Terry and William Parker, do hereby describe and ascertain the nature of our said invention to be, first, preventing or diminishing fermentation in the process of making sugar, and in the process of refining sugar, by the use of what we call ferrocyanic acid for that purpose; and, secondly, in the process of either refining or making sugar, promoting and increasing that effect called crystallization, and producing larger quantities of sugar by the use of sulphuric acid for that purpose.

And in further compliance with the said proviso, we, the said Charles Terry and William Parker, do hereby describe and ascertain the manner in which our said invention is to be performed by the following statement thereof (that is to say):

We use three solutions hereinafter described, and called, for the sake of distinction, Solution No. 1, Solution No. 2, and Solution No. 3.

For solution No. 1, take ten ounces, avoirdupois, of crystallized sulphate of zinc, and dissolve it in three gallons of cold water, then add three ounces, measure, of sulphuric acid, specific gravity 1.845. This is sufficient for one ton of raw sugar.

For solution No. 2, take nineteen ounces, avoirdupois, of best Prussian blue, in powder, and six ounces and a half, avoirdupois, of unslaked lime, also in powder, and thirteen pints and one-third, imperial measure, of distilled water. Digest them together at a moderate heat, say 120° Fahrenheit, in an earthen vessel, gently stirring this mixture, with wood, until all the blue colour has disappeared. Allow the whole to stand till it is cool, and then filter it. This liquid we call ferrocyanate of lime. It should be brought, by concentration or dilution, whichever may be requisite, to the specific gravity 1.020 when at 60° Fahrenheit. Ten pints, imperial measure, of this liquid is sufficient for one ton of raw sugar.

Solution No. 3, take ten ounces, avoirdupois, of crystallized sulphate of zinc, and dissolve it in five gallons of cold water, then add five ounces, measure, of sulphuric acid, specific gravity 1.845. This is sufficient for one ton of green syrups or molasses, with or without a mixture of sugar, to which respectively this solution is to be applied, as hereinafter pointed out.

In pointing out the above quantities of the several solutions with reference to a ton, we adopt this mode for convenience, but if more or less than a ton is to be operated upon, a proportional quantity of each of the solutions required is to be used accordingly.

Mode of application, &c.

We mix one ton of raw sugar with the usual quantity of water; boil it in a wooden or earthen vessel, in preference to metal, and remove the impurities as far as can be effected by scumming in the ordinary way (blood or white of eggs being employed in the usual manner for that purpose). We then boil this (which is called liquor) and while in a boiling state, we add to it the solution No. 1. We bring the liquor up to boiling again, and continue this boiling a few minutes, until a peculiar and

violent action in the liquid is produced, which will be immediately comprehended on trial; and we then immediately throw in three pounds of pulverised chalk, and add the solution No. 2, and then stir and boil the whole for five minutes. The whole may then be filtered, evaporated for crystallization, and completed in the usual manner, to produce lumps or loaves in moulds. But we prefer, as a better mode, that the white of eggs or bullock's blood and animal charcoal should be used in the usual manner, before filteration, after adding, and stirring, and boiling the solution No. 2, as above pointed out.

The green syrups, as they are called, which run from moulds, are to be submitted to the foregoing process, adding to them any proportion of raw sugar, but the solution, No. 3, is in this case to be used instead of No. 1, in the above specified quantity for every ton of the syrups and sugar so mixed, and five pounds instead of three of pulverized chalk are to be used, but solution No. 2, will be required in the same quantity and manner as before stated.

Green syrups without any addition of raw sugar may be subjected to this process, but we prefer the addition of sugar as pointed out above.

The green syrups remaining from the crystallization of green syrups, as above mentioned, may also be again subjected to the patent process, in like manner as the green syrups before described, but beyond this we do not propose to repeat our operations.

With reference to syrup or cane-juice from which sugar has not been separated or made, the proportion or quantity of saccharine matter or sugar which it contains is first to be ascertained by the saccharometer or other usual means, and then it is to be treated as raw sugar, the proportions of the solutions Nos. 1 and 2, and of the pulverized chalk or carbonate of lime, having reference only to the weight of saccharine matter or sugar which such syrup or juice contains.

We apply our process to the working of molasses in the mode above pointed out as to green syrups.

Now whereas the sulphate of zinc used in the solutions Nos. 1 and 3, is merely to decompose the ferrocyanate of lime: and whereas sulphuric acid has been used in the manufacture of sugar, but at a different period of the process, and for a totally different purpose than hereinbefore described: and whereas carbonate of lime has been used to neutralize the sulphuric acid when so used as last aforesaid: and whereas we use carbonate of lime or chalk also for the purpose of neutralizing the sulphuric acid, and for that only, therefore we do not claim as our invention the use of chalk hereinbefore described, or any other carbonate of lime for the purpose aforesaid, neither do we claim for the use of the exact quantities before described of the solutions, nor do we claim for the use of any particular compound of ferrocyanic acid, nor for the particular use of the salt called sulphate of zinc for the final removal of the ferrocyanic acid, since ferrocyanic acid in other states than in combination with lime, and other salts than sulphate of zinc may be used, though we prefer the process we have described. But we claim as our invention, first the use of ferrocyanic acid for preventing or diminishing fermentation in the process of refining sugar, and in the process of making sugar; and secondly, we claim the use of sulphuric acid in the making and in the refining of sugar for promoting and increasing that effect called crystallization and producing larger quantities of sugar. And such our invention being to the best of our knowledge and belief entirely new, and never before used within that part of his said Majesty's united kingdom of Great Britain and Ireland called England, his said Majesty's dominion of Wales, or town of Berwick upon Tweed, nor in any of his said Majesty's colonies or plantations abroad, we do hereby declare this to be our specification of the same, and that we do verily believe this our said specification doth comply in all respects fully and

without reserve or disguise with the proviso in the said hereinbefore in part recited letters patent contained. Wherefore we do hereby claim to maintain exclusive right and privilege to our said invention.—In witness whereof, &c.

Enrolled December 26, 1833.

LAW REPORTS OF PATENT CASES.

Court of Exchequer, Westminster, February 14, 1834. *Before Lord Chief Baron Lyndhurst and a Special Jury.*

RUSSELL *v.* COWLEY AND DIXON.

[*Concluded from our last, p.* 175.]

Mr. Donkin (continued) *cross-examined by the Solicitor General.*—Is acquainted with the draw-plate for drawing wire; that has been long known: it consists of conical graduated rings; lead pipes are drawn in the same way; the lead pipes are drawn cold. Was not acquainted with the mode of welding cylinders by rollers before 1825. In the welding by the rollers and by the die, the mechanical operation is different; but the union is the same in both—by pressure in a state of welding-heat. Did not know of the draw-plate being applied for elongating, forming, and scraping, before 1825; has used it for copper and brass, but not for drawing and scraping. Was very little acquainted with the process of making gun-barrels before 1825; there may have been many processes he (witness) knew nothing of. Has no doubt the process of heating iron rods for tubes in a blast-furnace was well known. Attempts have been made to weld upon a mandrel in a common furnace, but have failed. According to Russell's mode, the process is completed by once passing through the tongs; but it would not be prudent to trust to once passing only, but it may be done, if care is taken, in the adjustment of the width to the diameter.

At Russell's, the tubes were passed several times through the die, for the purpose of being scraped and elongated. A 1¼ inch tube was drawn once only, and tried first with a pressure of 84lbs., which it stood; then with 126lbs.; and ultimately with 168lbs., which it stood. Generally speaking, they may be completed by one passing, if care be taken: if the adaptation was nicely adjusted, there would be no necessity for a further operation. The three graduated holes in the tongs are for the purpose of lengthening the pipes, and bringing them to the diameter required.

Re-examined by Sir James Scarlett.—Remembers there was some objection raised by Mr. Dixon and Mr. Clark about the sand being used at plaintiff's and not at defendants'. Witness has employed sand in blast-furnaces for the last thirty years, to prevent the heat being abstracted. There was nothing in Cowley's manufactory to prevent their using it if they liked. All blacksmith's use it in welding. To accommodate the size of the hole to the tube wanted, would require more time and greater nicety. The weld is as complete at first as at any subsequent operation. After passing through the graduated holes, the internal and external surface is rendered smooth; this is not accomplished by the roller alone, but in a great measure by the scorpion. Messrs. Cowley, with their machinery, can make pipes as good as plaintiff's; but take away his scorpion, and leave him his roller only, and he cannot do it; if the rollers were taken away, and scorpions only used, it may be done then.

The Solicitor General said he would take the opinion of his lordship now, as to the validity of the specification. The patent is clearly void on the ground that too much is claimed. Even assuming that welding by a die is new, there is that claimed in the specification which is old. The real invention claimed is, that the iron is "passed through a pair of dies of the size required, by which means the edges of the iron will become welded to-

gether." All that goes before is old and notorious, but is claimed as new. There is nothing new in the "heating in a blast furnace," nor in "preparing a piece of flat iron with the edges bent up at the sides." As Sir James Scarlett had stated this mode of preparing the iron, and making what is called a skelp, was perfectly well known; but Whitehouse's patent embraced all that; and in no part of his specification does he confine it to the welding. Sir J. Scarlett referred to the words in the specification, "I do not confine myself to the employment of this precise construction of apparatus, as several variations may be made without deviating from the principles of my invention, which is to heat the previously proposed tubes of iron to a welding heat," &c.—that is the part he claims; but here, when he concentrates his claim, he says, "I do not confine myself," &c. But his invention is "to heat the previously proposed tubes of iron." He claims the heating just as much as the pressure.

The Chief Baron said he understood the invention to be —a tube of iron is prepared and heated to a welding-heat, and then drawn through pincers. The invention consisted in heating the previously prepared tubes of iron to a welding-heat, and then drawing it into the state required.

Solicitor General.—He claims the preparation of the tubes before they are submitted to the die, just as much as the compression by the die.

Chief Baron.—The principles of the invention are heating the tubes to nearly the point of fusion, and then drawing them between the dies, by which the edges are pressed together and the joint firmly welded. What you (Mr. Solicitor General) rely on, is the mode in which he does it.

Solicitor General.—He claims the whole; and if the whole were new, then the adoption of any part of it would be an infraction of the patent: the specification cannot be construed by referring to what is in the

private knowledge of your lordship—that the heating was known and notorious; but must be construed as if perfectly new, and then it would have been part of the invention claimed, and the adoption of it an infraction. He claims preparing the plough plate iron, then heating it in a blast furnace to nearly the point of fusion, just as much as putting it through the die, and so welding. The learned counsel then cited the case of *Macfarlane* v. *Price*, and also the case of *Hill* v. *Thompson*, and argued that because that was claimed in defendant's specification which was before known, that therefore the patent was bad.

Mr. Platt was about to follow the Solicitor General when he was interrupted by the

Chief Baron, who did not consider the objection tenable.

Mr. Platt hoped his lordship would take a note of the objection.

Mr. Richards followed on the same side.

Sir James Scarlett submitted that plaintiff did not claim the precise construction of apparatus; deviations may be made, therefore he may use another furnace if he likes.

Chief Baron.—Every person who prepares a specification, at the close states what it is he claims; and the fair way is to look how he claims it. The formal way of doing it is this: "The principles of my invention are these—to heat," &c. That is the whole of his claim; all the rest is a description of the manner in which it is effected. That is the way this instrument ought to be construed. All these objections may be taken at any future time, by application to this court or court of chancery.

Joseph Lindon (examined by *Mr. Rotch*). Is a machinist at Tipton in Staffordshire. Was formerly gas-tube manufacturer and contractor for Horsley's Iron company. Remembers the time when Whitehouse's in-

vention was first brought out: it made a great change for the better in the market. The market could not be supplied in consequence of the welders striking for wages. Witness explained the processes previously in use. Benjamin Willets was at one time in witness's employ: during the period he was in his employ, never heard of tubes being welded in Whitehouse's manner: it would have been impossible for Willets to have done any in this manner at witness' premises without his knowledge. All the pipes made at his (witness') factory passed twice through his hands. The appearance of gas-tubes made upon Whitehouse's principle was so different to the old principle, that he could not have failed to detect it. Knew Cook's patent, but never saw any of his tubes in the market any where.

Cross-examined by the Solicitor General.—Examined every pipe that left his premises. Never saw gun-barrels scraped or elongated by means of the draw-plate. Plaintiff's invention is the most superior he ever saw.

Re-examined by Mr. Rotch.—The change in the price of the article when plaintiff's invention came out believes was from 9d. to 6d. per foot.

Mr. Joseph Hobbins (examined by *Mr. Follett*).—Was in the service of Mr. Russell for some years before Whitehouse's discovery. When witness went into his service the price was 10d. per foot; then it came down to 9d.; afterwards it came down to 6d., and even lower than that in some instances. By the mode of making by hand, it would have been impossible to supply the demand. Plaintiff's pipes are used for general purposes: Mr. Perkins has had a great number of them for circulating hot water. Benjamin Cook of Birmingham has had some thousands of feet. Knows George Royal; he was in Mr. Russell's service formerly, while the patent manufactory was carried on, and assisted in making the tools for it: Royal went afterwards into the service of Messrs. Cowley.

Mr. M. I. Brunel, examined by *Sir J. Scarlett*.—Is an

engineer. Went down to see Mr. Russell's mode of making pipes with Mr. Donkin. The mode described by Mr. Donkin accomplished the object perfectly well. Was quite satisfied that the welding heat may be retained seventeen seconds, and probably much longer.

[The evidence of this gentleman was similar to that of Mr. Donkin; it will not, therefore, be necessary to repeat the account of the experiments]. The rollers do not make a round pipe. The rollers were not of the least use. The welding might have been done more speedily and more effectually by the scorpion. The roller is so ricketty and loose a thing, that it cannot make tubes perfect. Defendants could not make more than fifty tubes a-day, if they worked at the same rate as shewn to the inspectors, the process was so excessively long and dilatory. The increase of time must be a great increase of expense. The time it took at plaintiff's was much the shortest. The defendants' tongs are the same as that of plaintiff's. Considers plaintiff's invention of great utility.

Cross-examined by the Solicitor General.—Has seen some little about the manufacture of pipes, but not about gas-pipes. Was not interrupted in carrying on the experiments by the crowd. The rollers made some perfect welding, fit for gas-pipes in strength, but not in appearance. At Mr. Russell's the tube can be welded and completed by passing once through the die. One purpose of passing several times through the die, is, to lengthen the pipe. Defendant's scorpion is not for scraping. Water was dripping upon the bearings of the rollers at defendant's factory, but there was no necessity for it. Water was also dripping upon the scorpion.

Re-examined by Sir J. Scarlett.—The tongs were dipped in water each time at plaintiff's, so that the water was as effectual in the one case as in the other.

Mr. William Carpmael examined by *Mr. Rotch.*—The difference between the ordinary gas-tubes formerly ma-

nufactured, and those of Mr. Russell is very perceptible, and is evident to the most inexperienced.

Chief Baron.—These are very superior to the pipes manufactured in the old way.

Mr. Solicitor General.—No doubt it is a most useful process.

Chief Baron.—A useful and beneficial change from the old mode; you do not deny that?

Mr. Solicitor General.—No, my Lord.

Mr. Carpmael, continued.—It would not be possible to draw pipes, previously welded with the rollers, through the scorpion, without materially improving them. The edges would be more intimately welded by passing them through the scorpion at a welding heat. Any inequality in the welding or on the surface would be removed, and the surface made perfectly cylindrical. Thus tubes before unmarketable would be made marketable by drawing them at a welding heat through the scorpion.

Examined by the Chief Baron.—The welding would be improved if there were any defect. The tubes being at a welding heat the drawing them through the scorpion would complete the welding.

Examined by Mr. Rotch.—Tubes were formerly made about four feet. Mr. Russell makes them fifteen feet. The greater the length the more difficulty when made with a mandrel, which was the old plan. If water were used to fall on the chaps of the dies in the defendants' manufactory, that would not be sufficient to destroy the welding heat. It would scarcely have any effect; indeed, no perceptible difference would be observed for a considerable length of time. Water cannot be brought in contact with white hot iron. The operation of sand will not, under the circumstances, have any material effect in retaining the heat. The shortness of the time employed in drawing renders it unnecessary for the purpose of retaining heat. The sand is more used to keep the edges

of the iron clean than any thing else. Some tubes were made without sand. A piece of iron tube was made and welded by drawing it twice through the dies, and then carried to an anvil eighteen feet from the furnace, and beaten into a mass of iron*, thus evidently shewing the welding heat was retained at that distance. There were four or five tubes made without sand, but the gentleman paid no attention to them. Mr. Bramah expressed his dissent, and requested that no note as to his being in any way concerned in so absurd a request should be made, stating that sand was used by every blacksmith. Saw several pipes welded without their edges being rubbed through the sand. They were completely welded at the distance of fifty-six feet. Broke some of them on the beak-iron: they broke indifferently; that is, they did not break in the weld more than in the other parts.

Cross-examined by Mr. Richards.—The rollers are certainly of no use: the tendency of the different parts of the grooves to travel at different relative speeds would be to separate the metal when in nearly a fused state, and thus produce tubes any thing but cylindrical, even supposing the weld was good.

Examined by the Chief Baron.—The rollers are of the same diameter, but the grooves on them are of different diameter. The bottom of the groove in each roller is of less diameter than the outer diameter of the rolls, consequently the parts travel at different rates; thus there is a tendency to drag the outer part of the tube unequally, and to separate the fibre of the iron, which is drawn out only by the friction or adhesion to the surfaces of the grooves, and thereby produces pipes which are unequal on their surfaces.

Examined by Mr. Rotch.—The pipes could be made as perfect and as well as at Mr. Russell's, if they were

* The witness produced the mass of iron.

made with the scorpion alone and never passed through the rollers at all. The rollers are injurious.

Edward Humphreys, examined by *Mr. Follett.*—Is a millwright residing at Wednesbury. Made the rollers for defendants; they were so made that they might be stopped from rolling, and to draw the tubes without rolling at all. Put up the scorpion afterwards under the direction of Royal. Has seen defendants pass the tubes through the scorpion at a welding heat. Has seen the layter dropping from the iron while passing through. It takes about nine seconds in taking from the furnace and passing through the scorpion. Water was applied to the scorpion, at different times, to keep the iron cool. Witness fixed the machinery at plaintiff's mills. Defendants' holes are exactly the same as plaintiff's. Saw some trials made with the rollers without the scorpion, which did not succeed.

Cross-examined by the Solicitor General.—The scorpion was not part of defendants' original plan. Has seen the rollers tried alone many times, and they will not make complete welds. The superior roller is raised by a lever, to allow the tubes to be introduced. Never saw one upon this principle before.

Re-examined by Sir J. Scarlett.—The pressure on the rollers is not equal, because the outer part of the surface of the rollers turns so much quicker than the small part. Had no instructions for the scorpion at the same time as the rollers. Tongs were tried before the scorpion; the tongs were forced along the tubes in place of drawing the tube through the tongs. The use of the defendants' scorpion is the same as plaintiff's tongs.

Joseph Thursfield, examined by *Sir James Scarlett.*—Is a socket welder. Has worked for defendants. Defendants tried to make the pipes without rollers, with tongs only. Witness brought the tongs from Mr. Cowley's harness factory, in a bag, down to the mill. They were not worked in the day-time, but worked at night.

Cross-examined by Mr. Platt.—Richard Howel and George Royal were present when the pincers or tongs were used. Witness was sent out to watch; the engine was going at the same time.

Joseph Tomes examined by *Mr. Rotch.*—Had assisted in putting up the machinery in both plaintiff's and defendants' works. [The witness described defendants' mode of working similar to the preceding witnesses.]

Moses Hadley was examined on the same point.

William Russell, examined by *Mr. Follett.*—Worked at defendants' at the time they used the tongs. Recollects a law notice being served on Mr. Cowley, who gave orders to George Royal to cut up whatever tongs were about the place, which was done. Witness was present when they were cut up. The scorpion would weld the pipes without the rollers; the rollers are of no use at all.

Cross-examined by Mr. Platt.—Was in the service of defendants two years. Their ordinary mode was to pass them through the rollers first, and afterwards through the scorpion: they were not welded by the rollers, but by the scorpion.

Thomas Hayes, examined by *Mr. Rotch.*—Is a workman of Mr. Russell's. Went to Walsal several times to see what defendants were about. Went there on the 29th November, 1832. A man of the name of Lloyd went with witness, and a Mr. Lees went to a house of a man named Allen, where they could see the interior of defendants' factory, about 5 o'clock in the evening. Saw about forty tubes made in defendants' factory. They passed them through the scorpion at a welding heat; saw the layter fly off four or five yards: they passed them through the scorpion two or three times. Went several times afterwards to the same house for the same purpose; defendants' process was the same every time. Defendants did not know they were watched.

Cross-examined by Mr. Richards.—Witness looked from the chamber window; cannot tell whether there

was more windows than one in the room; thinks there was only one. It was the second floor; the building stands on a high hill.

David Lees, examined by *Mr. Follett.*—A watch-spring maker; one of the persons who went with the preceding witness to see defendants' mode of working. [This witness corroborated generally the evidence of the preceding; but did not see defendants use the scorpion.]

Thomas Edwards was examined, by *Sir. J. Scarlett*, as to defendants' mode of working. The first scorpion that was put up was a temporary one, bell-mouthed, and put the reverse way; but they could not make the tubes that way: told the men they must turn it the other way, which they did, and then succeeded in making good pipes. This was before they got the rollers; subsequently they got the rollers, and afterwards the scorpion. Has never seen them make pipes with the present scorpion; has seen them make them with the rollers and the temporary scorpion. Mr. Dixon asked witness what he thought of their mode of working; witness told him he did not consider it altogether right, but thought it rather an infringement of plaintiff's.

Benjamin Robinson and *James Robinson* gave evidence, similar to the preceding witnesses, as to the plan pursued by defendants.

The Court adjourned at a quarter past six.

Second Day.

The Chief Baron said he wished to ask Mr. Brunel and Mr. Donkin a question: his lordship then read to them the part of the specification where the invention states his claim. In the rollers, when the upper roller is down, its lower edge lies upon the upper end of the under roller, and there is a hole between the rollers, through which, by means of the revolution, the heated tube is drawn; what I want to know, is, whether that is not, without the scorpion, similar to plaintiff's invention? Is the same effect

produced by the rollers, though not so perfectly as by the dies? Is passing them through the roller similar, though not so perfect, as passing them through the dies or tongs?

Mr. Brunel.—So far as pressing the edges together, they are similar.

Chief Baron.—It is by pressure of the sides of the hole that the edges of the heated iron are welded together?

Mr. Brunel.—Quite so.

Chief Baron.—Then if it is a question of welding, is the one similar to the other?

Mr. Brunel.—It is similar, but not perfect.

His Lordship having asked Mr. Donkin if his opinion was the same, who replied in the affirmative,

The Solicitor General then addressed the Court and jury for the defendants, and rejoiced that the questions had been put to Mr. Donkin and Mr. Brunel. From these questions it is clear that the patent is not worth one farthing. A patent was obtained in 1811, by two persons named James and Jones, for welding by means of rollers, precisely upon the same principle as Whitehouse's. In substance they are the same; the process is to be completed by pressure by means of a circle, through which the object passes; whether that is done by rollers, or draw-bench, or sliding the ring inside the furnace, is wholly immaterial: whether the ring passes along the tube, or the tube is drawn through the ring, signifies not; the principle is the same—to produce a welding by circular pressure. When it is made out that this process was known subsequently to 1811, it will be clear plaintiff's is no invention, and that defendants' are entitled to a verdict. It is a matter of the last importance to defendants, who were carrying on the business of gas-pipe manufacturers, as they imagined, according to law; but suddenly an application was made for an injunction; and the very costs of these proceedings would have almost ruined

some people, such a number of affidavits were made, which so perplexed the court of chancery, that they sent the case to be submitted to a judge and jury. Not content with claiming an exclusive right, the plaintiff charges the defendants with gross fraud. Witnesses have been called to swear what will be most distinctly contradicted. It has been sworn that the rollers were a subterfuge, and that no *bona fide* use was made of them; that the tongs were used, and that the rollers were made a fixed die of; that the tongs were substituted for the rollers; and that in many instances an aperture was made in the furnace, the rollers wholly disregarded, and the skelps taken at once from the furnace to the scorpion, so that under the pretence of using Royal's patent, they took them at once, without the formality of passing through the rollers to the scorpion. That the testimony you have heard is false, will be proved to demonstration. Thursfield, Hadley, and others, swore that it was constantly happening, that they passed the tubes from the furnace through the scorpion, without the rollers being used at all. They said this was done in the presence of Royal, Lees, Beech, and Green. These witnesses, and others, will be called, who will completely disprove that; who will prove that defendants always carry on their works in the manner they did when Mr. Brunel and Mr. Donkin were there—through the rollers and then through the scorpion. Hayes and Lees will be shewn, by mathematical demonstration, to have been guilty of perjury. It was utterly impossible they could have seen either the roller or the scorpion from Allen's house, unless they could see through a nine-inch wall, or round a corner.

[The learned counsel then explained from a model the situation of Allen's house and defendants' factory.]

If it had been proved that tubes had on any occasion been made without the rollers, that would not settle the question. It has been said, that the engine was worked in the night-time, but that is false; a boy was employed

to get up the steam; and there was no clandestine use made of the engine at night. The real question to be tried, is, whether Whitehouse's patent is a good one, and if so, whether defendants have infringed it: whether it has been infringed or not, the patent is not worth one farthing.

First, this patent is invalid. There must be a discovery in order to entitle any one to a patent; if what is claimed was well known before, the patent is void. The process that Whitehouse patented was perfectly well known; not only welding by rollers, but passing through a conical ring, and also forcing the tube through a die. A patent was taken out in 1808 by Benjamin Cook, not for welding, but for the purpose for which the die-plate was used. Cook takes plates of iron or steel and forces them through graduated holes. The welding is done by the mandrel; but then he draws or forces them through the graduated holes, and passes them between rollers with grooves in them. The problem was the proper mode of completing the tube when welded, and this was done by drawing through the draw-plate. Cook's draw-plate is defendants' scorpion, neither more nor less. The draw-plate is for elongating and forming, the scorpion is the same. Sir James Scarlett says plaintiff claims for perfecting the pipes; but upon that ground alone his patent is demolished by this of Cook's in 1808. Another patent was taken out in 1811, by James and Jones, for welding by means of rollers, grooved to fit the form of the barrel, having either an alternate or rotatory motion. Now that is the exact way in which the defendants' make their rollers. It was on the expiration of that patent that Royal's was taken out. But it will be shewn by two witnesses that the mode of making gas-pipes by, not merely the rollers, but the die, was known before 1825, that they practised it long before the plaintiff's patent; these men got information of this mode of making gas-pipes, and they practised it secretly, and thus made more pipes

than they otherwise could have done; they made them by what is called a gripe, which is a pincer or die, through which they made the pipe pass when at a welding heat.

But if it be thought that the specific mode of welding by the die only is claimed, then it will be shewn there has been no infraction. If that patent were good, it has never been infringed by defendants. Fig. 4, in Whitehouse's patent, one of the modes claimed, is precisely the same as the gripe that was used by the two witnesses, Willets and Horner. Why was not Whitehouse, the inventor of plaintiff's mode, produced as a witness? Royal will be called to shew the experiments he made; his discovery is the mode of arranging the rollers; he fixed the rollers flush into the wall, having one movable, which might be elevated or depressed by a lever and manual labour; and thus the welding was more complete than by the fixed ring, and for this he took out his patent. The iron was put into an air furnace, then passed through the rollers at a proper heat; the upper roller having been raised, is then replaced, and a cylindrical circle formed, the machine is set in motion, and by the pressure the tubes are completely welded: they are then projected to the scorpion, which elongates, scrapes, and cleanses, and so fits them for sale. The novelty is the peculiar construction of the rollers; this is what is claimed—the doing the welding by rollers in a more effectual way. From the time of Royal's patent being taken out, to the present time, defendants' business has been conducted exactly according to that mode described in the specification; the scorpion has never been applied except for the purpose of lengthening and scraping. Mr. Brunel and Mr. Donkin, who, before their visit to Walsal, knew very little about making tubes, say that the scorpion at least furthers, advances, and improves the welding; but if the welding has once been completed, you cannot discover where it has been effected;

therefore if the rollers weld perfectly, there can be no improvement in the welding by passing through the scorpion. In respect to the time, these gentlemen will be contradicted by persons of more experience than themselves. In the experiments made of carrying fifty-five feet, they all failed, except one, where a flux was not used. The use of the flux is to prevent the atmospheric air from approaching the iron, and withdrawing the heat, and keeping it at a welding heat a good many seconds longer. In no instance was a flux used at defendants', but the welding was completed by the rollers, with water dropping on them, which prevented the welding heat from continuing in the scorpion.

A good deal has been said about the layter, the falling of which is a test that it is at a welding heat; but what Mr. Brunel and Mr. Donkin saw was not layter, but what is called swarf, and this may be mistaken by inexperienced persons for layter. Mr. Carpmael is the only other scientific witness in the cause; but why have they not called iron masters, and manufacturers of gun-barrels or gas-pipes? Mr. Clegg will be called on the part of the defendants, the person who first introduced gas into the country, and has been acquainted with the making of gas-pipes many years. He will state, that there is no welding by the scorpion: the rollers do not make perfect pipes, but as far as the welding goes they do it much more effectually than the dies. Mr. Bramah will also be called for defendants. Mr. Bramah was under a mistake at one time in supposing the scorpion was not sufficient to produce a welding, but on further examination, he found reason to correct his mistake. But he will still state that the welding is completed by the rollers. Mr. Thorneycroft, Mr. Cook, and others, will prove the same point; and also a considerable number of defendants' workmen. The use of the rollers is that they weld more effectually and expeditiously than the draw-plate.

After some discussion between his lordship and the

learned counsel, Mr. Solicitor General stated, that, on further consideration, he would not call any witnesses, but would rely on the objections at law, taken by him, to the plaintiff's specification, which he contended was bad in having claimed too much: that the manner set forth in the plaintiff's specification was, in substance, the same as that described in the specification of James and Jones in 1811.*

His Lordship directed the jury to find a verdict for the plaintiff.

On the Manufacture of Oil and Spirit Varnishes, Gold Lackers, Gold Size, &c. By J. Wilson Neil, 21, King's Cross, Battle Bridge.

[*Continued from p.* 195.]

Directions for clarifying Oil for Varnish.

Procure a copper pan, fig. 9, made like a common washing-copper, which will contain from fifty to eighty gallons, as occasion may require; when wanted, set it upon the boiling furnace, fig. 5, and fill it up with linseed-oil within five inches of the brim. Kindle a fire in the furnace underneath, and manage the fire so that the oil shall gradually but slowly increase in heat for the first two hours; then increase the heat to a gentle simmer, and if there is any scum on the surface, skim it off with a

* For James and Jones's specification, see Repertory, page 265, vol. xx., Second Series; but for the benefit of those of our readers who do not possess that part of this work, we extract the words which Mr. Solicitor General contends are the same in principle and effect as Whitehouse's invention.

After describing the manner of welding by hammering, the specification goes on to say, "Or, instead of welding the barrels by hammers, a pair of rollers, grooved to fit the form of the barrel, the rollers having either an alternately or rotary motion, worked by steam, water, or other mechanical powers, but we consider the hammers to be the best method." They then go on to say, that in either case the mandrel or stamp is to be as quickly taken out as possible.

copper-ladle, and put the skimmings away. Let the oil boil gently for three hours longer, then introduce, by a little at a time, one quarter of an ounce of the best calcined magnesia for every gallon of oil, occasionally stirring the oil from the bottom. When the magnesia is all in, let the oil boil rather smartly for one hour; it will then be sufficient. Lay a cover over the oil to keep out the dust while the fire is drawn and extinguished by water; then uncover the oil, and leave it till next morning; and then, while it is yet hot, ladle it into the carrying jack, or let it out through the pipe and cock: carry it away, and deposit it in either a tin or leaden cistern, for wooden vessels will not hold it; let it remain to settle for at least three months. The magnesia will absorb all the acid and mucilage from the oil, and fall to the bottom of the cistern, leaving the oil clear, transparent, and fit for use. Recollect, when the oil is taken out, not to disturb the bottoms, which are only fit for black paint.

Directions for making Varnish on the small scale with the fewest Utensils.

First procure a gum-pot, No. 3, or smaller, if required; then a three-footed iron trevet with a circular top, the feet sixteen inches in length, and made to stand wider at the bottom than top, which is to be made so as the pot will fit easily into it. Place the trevet in a hollow in a field, yard, garden, or out-house, where there can be no danger from fire; raise a temporary fire-place round the trevet with loose bricks, after the same manner that plumbers make their furnaces; then make up a good fire with either coke, coal, or wood-charcoal, which is far preferable; let the fire burn to a good strong heat, set on the gum-pot with 3lb. gum copal: observe, that if the fire surround the gum-pot any higher inside than the gum, it is in great danger of taking fire. As soon as the gum begins to fuse and steam, put in the copper stirrer, and keep cutting, dividing, and stirring the gum to assist its fusion; and if

it feels lumpy and not fluid, and rises to the middle of the pot, lift it from the fire and set it on the ash-bed, and keep stirring until it goes down (mean time let the fire be kept briskly up); then set on the gum-pot again, and keep stirring until the gum appears fluid like oil, which is to be known by lifting up the stirrer so far as to see the blade. Observe, that if the gum does not appear quite fluid as oil, carry it out whenever it rises to the middle of the pot, and stir it down again (keep up a brisk fire), put on the pot, and keep stirring until the gum rises above the blade of the stirrer, call out to the assistant, "Be ready." He is then, with both hands, to lay hold of the copper pouring-jack, charged with clarified oil from No. 2, and lean the spout about one inch and a half over the edge of the gum-pot; let him keep himself firm, steady, and collected, and not flinch, spill, or pour the oil, which would perhaps set all on fire. Observe when the gum rises within five inches of the pot-mouth, call out, "Pour:" the assistant is then to pour in the oil very slowly until towards the last, the maker stirring during the pouring.

If the fire at this time is strong and regular, in about eight or ten minutes the gum and oil will concentrate and become quite clear: this is to be tested by taking a piece of broken window-glass in the left hand, and with the right lifting up the stirrer and dropping a portion of the varnish on it; if it appears clear and transparent, the oil and gum are become concentrated or joined together. It is now to be further boiled until it will string between the finger and thumb: this is known by once every minute dropping a portion on the glass, and taking a little between the fore-finger and thumb; pinch it first, then extend wide the finger and thumb: if it is boiled enough, it will stick strong and string out into fine filaments, like bird-lime; but when not boiled enough, it is soft, thick, and greasy, without being stringy. The moment it is boiled enough, carry it from the fire to the ash-bed, where let it

remain from fifteen to twenty minutes, or until it is cold enough to be mixed; have at hand a sufficient quantity of oil of turpentine to fill the pouring pot; begin and pour out with a small stream, gradually increasing it, and if the varnish rises rapidly in the pot, keep stirring it constantly at the surface with the stirrer to break the bubbles, taking care not to let the stirrer touch the bottom of the pot, for if it should, the oil of turpentine would be in part converted into vapour, and the varnish would run over the pot in a moment; therefore, during the mixing, keep constantly stirring as well as pouring in at the same time. Have also a copper ladle at hand, and if it should so far rise as to be unmanageable, let the assistant take the ladle and cool it down with it, lifting up one ladleful after another, and letting it fall into the pot. As soon as the varnish is mixed, put the varnish-sieve, No. 1, in the copper funnel placed in the carrying-tin, and strain the varnish immediately; empty it into open-mouthed jars, tins, or cisterns; there let it remain to settle, and the longer it remains the better it will become. Recollect, when it is taken out, not to disturb or raise up the bottoms.

General Observations and Precautions to be observed in making Varnishes.

Previous to beginning to make varnish, take care that the making-house is completely cleared of every unnecessary article. Have every necessary article perfectly clean and in good order. If the weather is fine, at a convenient distance outside sift some dry ashes through a fine sieve to form an ash-bed; make it a little larger than the bottom of the boiling-pot, one inch and a half deep, and smooth and level on the surface, on which set the boiling-pot every time it is necessary to bring it out.

About four feet from the ash-bed erect a circle of loose bricks four courses high; lay them so that when the gum-pot is set within it it will rest securely by its flange, with

the bottom about six inches from the ground. Upon this brick-stand set the pot each time there is occasion to carry it out, and stir it down; four feet from the stand set the iron trevet for turning up the gum-pot each time after it is washed out, as by so doing it will always be kept clean, and cool gradually; for, by cooling very rapidly, copper oxidises very quickly. Near the trevet set the large wide tin jack, ready to receive the washings; also the swish-broom each time the pot is washed out. Have also at hand one copper ladle, and a tin bottle with three gallons of oil of turpentine for washing with when wanted. Supposing every thing so far ready, if both the boiling-pot and gum-pot are to be used at the same time, let the assistant lay the fire ready, set on the boiling-pot with eight gallons of oil, kindle the fire; then lay the fire in the gum-furnace, have as many 8lb. bags of gum all ready weighed up as will be wanted, put one 8lb. into the pot, put fire to the furnace, set on the gum-pot; in three minutes (if the fire is brisk) the gum will begin to fuse and give out its gas, steam, and acid; stir and divide the gum, and attend to the rising of it, as before directed: 8lbs. of copal takes, in general, from sixteen to twenty minutes in fusing, from the beginning till it gets clear like oil; but the time depends very much on the heat of the fire and the attention of the operator. During the first twelve minutes, while the gum is fusing, the assistant must look to the oil and bring it to a smart simmer, for it ought to be neither too hot nor yet too cold, but in appearance beginning to boil, which he is strictly to observe, and, when ready, call out, "Bear a hand;" then immediately each lay hold of one handle of the boiling-pot, lift it right up so as to clear the plate, carry it out and place it on the ash-bed, the maker instantly returning to the gum-pot, while the assistant puts three copper ladlefuls of oil into the copper pouring-jack, bringing it in and placing it on the iron plate at the back of the gum-pot to keep hot until wanted. When the maker finds the gum is nearly all completely fused,

and that it will in a few minutes be ready for the oil, let him call out, "Ready oil;" the assistant is then to lift up the oil-jack with both hands, one under the bottom and the other on the handle, laying the spout over the edge of the pot, and wait until the maker calls out, "Oil:" the assistant is then to pour in the oil as before directed, and the boiling to be continued until the oil and gum become concentrated, and the mixture looks clear on the glass; the gum-pot is then to be set upon the brick-stand until the assistant puts three more ladlefuls of hot oil into the pouring-jack, and three more into a spare tin for the third run of gum. There will remain in the boiling-pot still 3½ gallons of oil. Let the maker put his right hand down the handle of the gum-pot near to the side, with his left hand near the end of the handle, and with a firm grip lift the gum-pot, and deliberately lay the edge of the gum-pot over the edge of the boiling-pot, and gently raise up the bottom of the gum-pot until all its contents run into the boiling-pot. Let the gum-pot be held, with its bottom turned upwards, for a minute right over the boiling-pot. Observe, that whenever the maker is beginning to pour, the assistant stands ready with a thick piece of old carpet, without holes, and sufficiently large to cover the mouth of the boiling-pot should it catch fire during the pouring, which will sometimes happen if the gum-pot is very hot; should the gum-pot fire, it has only to be kept bottom upwards, and it will go out of itself; but if the boiling-pot should catch fire during the pouring, let the assistant throw the piece of carpet quickly over the blazing pot, holding it down all round the edges; in a few minutes it will be smothered. The moment the maker has emptied the gum-pot, throw into it half a gallon of turpentine, and with the *swish* immediately wash it from top to bottom, and instantly empty it into the flat tin jack: wipe the pot dry, and put in 8lbs. more gum, and set it upon the furnace; proceed with this run exactly as with the last, and afterwards with the last or third run. There will then

be 8 gallons of oil and 24lbs. of gum in the boiling-pot, under which keep up a brisk strong fire until a scum or froth rises and covers all the surface of the contents, when it will begin to rise rapidly. Observe, when it rises near the rivets of the handles, carry it from the fire, and set it on the ash-bed, stir it down again, and scatter in the driers by a little at a time; keep stirring, and if the frothy head goes down, put it upon the furnace, and introduce *gradually* the remainder of the driers—always carrying out the pot when the froth rises near the rivets. In general, if the fire be good, all the time a pot requires to boil, from the time of the last gum being poured in, is about three and a half or four hours; but *time* is no criterion for a beginner to judge by, as it may vary according to the weather, the quality of the oil, the quality of the gum, the driers, or the heat of the fire, &c.; therefore, about the third hour of boiling, try it on a bit of glass, and keep boiling it until it feels strong and stringy between the fingers—it is then boiled sufficiently; carry it on the ash-bed, and stir it down until it is cold enough to mix, which will depend much on the weather, varying from half an hour in dry frosty weather to one hour in warm summer weather. Previous to beginning to mix, have a sufficient quantity of turpentine ready, fill the pot, and pour in, stirring all the time at the top or surface, as before directed, until there are fifteen gallons, or five tins, of oil of turpentine introduced, which will leave it quite thick enough, if the gum is good and has been well run; but if the gum was of a weak quality, and has not been well fused, there ought to be no more than twelve gallons of turpentine mixed, and even that may be too much. Therefore, when twelve gallons of turpentine have been introduced, have a flat saucer at hand, and pour into it a portion of the varnish, and in two or three minutes it will shew whether it is too thick; if not sufficiently thin, add a little more turpentine, and strain it off quickly. As soon as the whole is stored away, pour in the turpentine

washings with which the gum-pots have been washed into the boiling-pot, and with the swish quickly wash down all the varnish from the pot-sides; afterwards, with a large piece of woollen rag dipped in pumice-powder, wash and polish every part of the inside of the boiling-pot, performing the same operation on the ladle and stirrers; rinse them with the turpentine washings, and at last rinse them altogether in clean turpentine, which also put to the washings: wipe dry, with a clean soft rag, the pot, ladle, stirrer, and funnels, and lay the sieve so as to be completely covered with turpentine, which will always keep it from gumming up. The foregoing directions concerning running the gum and pouring in the oil, and also boiling off and mixing, are, with very little difference, to be observed in the making of all sorts of copal varnishes, except the differences of the quantities of oil, gum, &c., which will be found under the various descriptions by name, which will be hereafter described.

[*To be continued.*]

PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

Results of Dr. Stark's Researches on the Influence of Colour on the Absorption and Radiation of Heat.—In our first article on the "Progress of Science, &c." (Repertory, N. S. present volume, p. 29), we inserted an abstract of Dr. Stark's paper "On the Influence of Colour on Heat and Odours." This valuable paper having since been published at large in the "Philosophical Transactions," we proceed to extract a portion of its more important contents. Dr. Stark's methods of investigation were noticed in the abstract, as well as the general accordance of his results on the absorption of heat, with those of Franklin and of Davy: the annexed table exhibits a comparison of the order of the absorbing powers of the different colours as deduced from the experiments of those philosophers and of Dr. Stark himself.

FRANKLIN. Coloured Cloths.	DAVY. Coloured Metal.	STARK. Coloured Wool.	STARK. Coloured Ball of Thermometer.
Black	Black	Black	Black
Deep Blue	Blue	———	Dark Blue.
Lighter Blue	———	———	Brown
Green	Green	Dark Green	Green
Purple	———	———	———
Red	Red	Scarlet	Orange Red
Yellow	Yellow	———	Yellow
White	White	White	White

It was also noticed in the abstract that Dr. Stark's experiments had shewn that the loss of heat by radiation follows exactly the same order, with regard to the colour of the radiating surface, as its absorption. After relating in detail his researches on this branch of the subject, he enters into the following consideration of the importance in nature of the principles which he has demonstrated.

The demonstration of the influence of colour on the absorption and radiation of caloric may tend to open up new views of the economy of nature, and perhaps suggest useful improvements in the management and adaptation of heat. Dr. Franklin (Dr. Franklin's works, London 1806; vol. ii. p. 109) who never lost sight of practical utility in his scientific investigations, from the result of his experiments with coloured cloths on the absorption of heat, drew the conclusion, "that black clothes are not so fit to wear in a hot sunny climate or season as white ones, because in such clothes the body is more heated by the sun when we walk abroad and are at the same time heated by the exercise; which double heat is apt to bring on putrid, dangerous fevers;" that soldiers and seamen in tropical climates should have a white uniform; that white hats should be generally worn in summer; and that garden-walls for fruit trees would absorb more heat from being blackened.

Count Rumford and Sir Everard Home, on the contrary, came to a conclusion entirely the reverse of this. The Count asserts, that if he were called upon to live in a very warm climate, he would blacken his skin or wear a black shirt; and Sir Everard, from direct experiments on himself and on a negro's skin, lays it down as evident, "that the power of the sun's rays to scorch the skins of animals is destroyed when applied to a dark surface, although the absolute heat, in consequence of the absorption of the rays, is greater (Phil. Trans. 1821, p. 6)." Sir Humphry Davy explains this fact by saying "that the radiant heat in the sun's rays is converted into sensible heat." With all deference to the opinion of this great man, it by no means explains why the surface of the skin was kept comparatively

cool. From the result of the experiments detailed, it is evident, tha if a black surface absorbs caloric in greatest quantity, it also gives it out in the same proportions: and thus a circulation of heat is as it were established, calculated to promote the insensible perspiration, and to keep the body cool. This view is confirmed by the observed fact of the stronger odour exhaled by the bodies of black people.

The different shades of colour by which races of men inhabiting different climates are distinguished, equally possess, there is reason to believe, the quality of modifying the individual temperature, and keeping it at the proper mean. This adaptation of colour may perhaps be traced in the inhabitants of every degree of latitude, and be found to correspond with the causes which limit the range of plants and animals. The effect of exposure to the sun in our own country in warm seasons, is temporarily to change the colour of the parts submitted to its influence, and to render them less susceptible of injury from the heating rays.

The influence of colour as modifying the effects of heat, is also strikingly illustrated in other classes of the animal kingdom. The quadrupeds, for instance, which pass the winter in northern latitudes, besides the additional protection from cold they receive in the growth of downy fur, change their colour on the approach of the cold season. The furs of various hues which form their summer dress are thrown off, and a white covering takes its place. Hence the white foxes, the white hares, and the ermine of the arctic regions. Even in more temperate climates, and in our own country, the hare in severe winters often acquires a white fur, and the stoat, or ermine, is found with its summer dress more or less exchanged for a winter clothing of pure white. Some writers on natural history state these changes as means of protection to the animals from their enemies, by assimilating their colour to the winter snow. Without denying that this may be one cause for the periodical change of colour, I am rather disposed to consider it as accommodating the animal to the changes of season it undergoes. The white winter coating, as is evident from the experiments detailed, does not throw off heat so rapidly as any of the other colours; and hence its use in preserving the animal temperature.

The feathered tribes which inhabit northern latitudes afford still more remarkable instances of the adaptation of colour to the changes of temperature. The summer dress of many families is so different from their winter plumage as to have led many ornithologists to multiply species, as the animal was described in its winter or summer plumage. The ptarmigan is a familar example. Mr. Selby remarks, that "the black deep ochreous yellow plumage of the ptarmigan in spring and summer gradually gives place to a greyish white; the black

spots become broken and assume the appearance of zigzag lines and specks. These again, as the season advances, give place to the pure immaculate plumage which distinguishes both sexes in winter." (Selby's Illustrations of British Ornithology, Part I. p. 312.)

The display of colours in the plumage of the birds of tropical climates is also in strict accordance with the observed facts of the influence of colour over the absorption and radiation of heat. The metallic reflections and polished surface of the whole family of humming birds is admirably suited to their habits; and the colours of the wings of the Lepidoptera, in the class of insects, there is little doubt, serve some similar purpose, in maintaining the temperature of the animals at the proper mean. In proportion to the diminution of temperature and the distance from the equator, a corresponding dilution of colour in animals takes place, till, in temperate countries, it is almost uniformly of a sober gray. In the arctic regions all colour except white and black disappears,—modifications of which, with very little variety of other colours, form the summer and winter clothing of most of the northern tribes of birds.

In the vegetable kingdom, I am disposed to believe that the colours of the petals of flowers serve some useful purpose in regard to preserving the temperature of the parts necessary for reproduction at the proper mean; and that the varied pencilling of nature has thus an object beyond merely pleasing the eye. In this view, the quality of colour, so widely extended, and so varied and blended in every class of natural bodies, acquires a further interest in addition to its ministering to the pleasures of sight, and affords a new instance of that benevolence and wisdom by which all the arrangements of matter are calculated to excite and gratify the mind directed to their investigation.

Even in the inorganic portion of nature, and in northern climates, the portion of heat imbibed by the soil during a short summer is prevented from escaping by the covering of snow which falls in the beginning of winter; and thus the temperature necessary for the scanty vegetation is kept up. By this white covering vegetables are enabled to sustain a lengthened torpidity without suffering from the injurious effects of frost; and the ground is preserved from partial alternations of temperature, till the influence of the sun at once converts the northern winter into summer without the intervention of spring.—*Phil. Trans.* 1833, *Part* ii. *pp.* 291—298.

New Principle in Statics developed by Professor Moseley, called "the Principle of Least Pressure;" together with its Application to the Theories of the Wedge and of the Arch.—In the *Lond. and Edin. Phil. Mag.* for October and December last, the Rev. H. Moseley, B. A. Professor of Natural Philosophy in King's College, London, has enunciated for the first time, and developed at some length, a new principle in statics, which

he calls the *principle of least pressure*, stating it in the following theorem :—

If there be a system of forces in equilibrium among which there enter the resistances of any number of fixed points, then are these resistances such that their sum is a MINIMUM; *each being considered a function of the co-ordinates of its point of application, taken with a positive sign, and subjected to the conditions imposed by the equilibrium of the whole.*

Of this theorem, Prof. Moseley gives the subjoined demonstration :—

"Let there be conceived a system of forces of which a certain number are *given* in magnitude and direction, and the rest are supplied by the *resistances* of as many fixed points. Also let the *points of application* of the forces of the system be *supposed* to be given.

"Let A designate the *given* forces of the system, B the resistances, and C any other system of forces which, being applied to the same points with the forces of the system B, would maintain the equilibrium. Also let the system C be supposed to replace the system B.

"Now each force of the system C, under these circumstances, *just* sustains and is equivalent to the pressure propagated to its point of application by the forces of the system A; or it is equivalent to that pressure, *together with* the pressure propagated to its point of application by the *other* forces of the system C.

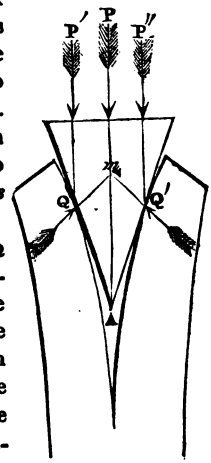
"In the former case it is identical with the corresponding *resistance* of the system B. In the latter case it is *greater* than it.

"The sum of the forces of the system B, each being considered *a function of the coordinates of its point of application*, is, therefore, a MINIMUM."

Mr. Earnshaw, of St. John's College, Cambridge, F.C.P.S., having questioned, in the *Phil. Mag.* for February, the validity both of the foregoing principle and of its demonstration, they have been defended by their author, in the same work for March, (from which indeed we derive the demonstration, as given above). After supporting his views both by abstract reasoning and by the analytical investigation of a somewhat complicated case of resistance, Prof. M. proceeds further to verify the principle he has enunciated by applying it to the theories of the wedge and of the arch. We cannot pretend to decide the cause at issue between these two mathematicians, but conceiving that Prof. Moseley's illustrations of the theories just named (whether essentially dependent upon his new principle or not,) are, in themselves, of considerable practical importance, we deem it expedient to present them to our readers, as follows :—

"*The theory of the* WEDGE presents an application of the principle of least pressure under its simplest form, leading to a result which is of some practical importance, and, as I believe, altogether *new*.

"Let P, be the force acting upon the back of the wedge, Q and Q′ the *resistances* upon its sides. Now by the principle of least pressure Q and Q′ should be the least possible subject to the condition that their resultant shall be P. It is manifest that to satisfy this condition these forces must have a direction *parallel* to the direction of P, or one inclined *as little as possible* to that direction.



"If, therefore, the surfaces in contact at Q and Q′ are such as are capable of supplying resistances at those points *parallel* to P, then the system will be one of *parallel* forces, and the points Q and Q′ being similarly situated with respect to P A, each will sustain one half of the force P. But if, by reason of the *nature* of the surfaces in contact at Q and Q′, these be incapable of supplying resistance in directions parallel to P A*, then will the directions of Q and Q′ be those which the surfaces will supply *nearest* to the direction of P A.

"Now, as is shewn in the note, there is a certain direction between which and the normal at either point, if any force be applied, the surfaces will supply a resistance opposite to that force, but if the force be applied further from the normal than this direction, then *no* resistance will be afforded by the surfaces in an *opposite* direction. The angle which this direction makes with the normal may be called the *limiting angle of resistance*. The resistances Q and Q′ will manifestly have their directions inclined to P A at the *least possible* angles, when they are actually in the directions spoken of above, and make each

"* The following is a principle of statics, of great practical importance, from which the possibility of this supposition will be evident. Let p be a force pressing two *surfaces* together *obliquely*, and let θ be its inclination to the normal at the point of contact; then $p \sin \theta$ and $p \cos \theta$ are the resolved parts of p, parallel and perpendicular to the surfaces at their common point of contact. Let the coefficient of friction equal the tangent of a certain angle, which call α. Therefore the actual amount of the friction, being the product of the *perpendicular* pressure by the coefficient of friction, is represented by $p \cos \theta \tan \alpha$. Now this power of resistance acts in a direction *parallel* to the surfaces at their point of contact, and in a direction opposite to the horizontal part of the force p, which is $p \sin \theta$. Hence, therefore, there will be an equilibrium or not, according as

$$p \sin \theta \text{ is, or is not, less than } p \cos \theta \tan \alpha,$$

or according as $\tan \theta$ ———————————— $\tan \alpha$.

The surfaces will, therefore, not supply a resistance whose direction is inclined to the normal at an angle θ, greater than that angle α whose tangent is the coefficient of friction.

with the normal at its point of application an angle equal to the limiting angle of resistance. Such, then, by the principle of least pressure, are the actual directions of the pressures at Q and Q′.

"Now let us consider what are the conditions of the equilibrium resulting from this conclusion.

Let $\alpha =$ the limiting angle of resistance,
$2\,\iota =$ the angle A of the wedge.

The angle which Q makes with the side of the wedge is

$$\frac{\pi}{2} - \alpha.$$

Hence, therefore, the angle Q *m* A, which makes it with P A, is

$$\frac{\pi}{2} - \alpha - \iota.$$

Hence, therefore, the resolved part of Q in the direction P A is

$$Q \,.\, \sin(\alpha + \iota),$$

and the wedge being symmetrical about P A, the resolved part of Q is the same. Hence

$$2\,Q \sin(\alpha + \iota) = P;$$

$$\therefore\ Q = \frac{P}{2\sin(\alpha + \iota)}.$$

If
$$\alpha + \iota = \frac{\pi}{2},$$

$$Q = \tfrac{1}{2}\,P.$$

"This is the case spoken of before, in which the directions of Q and Q′ are parallel.

"Now the above results may be arrived at by another and an entirely independent process of reasoning.

"Let P′ and P″ each equal one half of P, and let them be applied immediately above the points Q and Q′; they may then be made to replace P without in the least altering the circumstances of the equilibrium. Now if the direction of P′ Q be *within* the limits of the resistance of the surfaces at Q, the pressure P′ will be *wholly* sustained by that resistance, and the direction of the force Q will be in the same straight line with P′ Q; the wedge sustaining no pressure whatever laterally or in a direction perpendicular to P A. But if the direction of P′ Q be *without* the limits of resistance at Q, then some other force must be supplied at Q, in order to maintain the equilibrium. That force can only result from the action of the force P″ at Q′. It acts, therefore, in the line Q′ Q, and therefore in a direction perpendicular to P A. Also, this force, resulting from the tendency of the wedge to motion on the point Q″, is only just equal to that tendency, or in other words, it is equal to the least force which would keep that point at rest. Since, then, it is equal to the least force which would keep the point Q′ at rest, it is also equal to the least force which would keep the point Q at rest: now the least force which would keep Q at rest is manifestly

hat which will bring the direction of the resistance at Q just within the limiting angle of resistance at that point. Thus, then, it appears that the directions of Q and Q′ are inclined to the normals at those points at angles each of them equal to the limiting angle of resistance. This is precisely the result which is given us at once, by the principle of least pressure.

"There are numerous applications of the principle of least pressure in the theory of statics which admit of a verification similar to the above. Take, for instance, the theory of the ARCH. The pressures upon the surfaces of the abutment and keystone should, by that principle, be each a minimum, subject to the condition that they should be sufficient to sustain the semiarch, if it formed one continuous solid, and that the pressure on the key should be *horizontal*. Now the weight of the semiarch being given, as the pressure upon the key diminishes, that upon the abutment also diminishes. Also, the pressure upon the key tending to support either semiarch results from the tendency of the opposite semiarch to motion, and is just equal to that tendency. It is therefore equal to the *least force* which would support that semiarch, and therefore to the least force which would support the first-mentioned semiarch; or it is a minimum subject to the conditions, and therefore the pressure upon the abutment is also a minimum. And the positions of the resultants of the pressures upon the different points of the key and abutments, as well as the magnitudes of those resultants are subject to this law.

"It is evident, that an infinite number of different forces might be applied at an infinite number of different points of the keystone, each of which would support the semiarch; of these one only is that which will *just* sustain it. I have discussed this subject fully in a paper read before the Cambridge Philosophical Society during the last term.

"Here, then, we have verified another application of the principle of least pressure, and it is shewn to constitute a most important element in he true theory of the arch, determining the position of its line of pressure, and thence all the conditions of its equilibrium."

ON THE COAL-FIELDS OF THE MIDLAND AND SOUTH-WESTERN COUNTIES. BY PROF. SEDGWICK.—In the third part of Prof. Sedgwick's communication to the Philosophical Society of Cambridge on the geology of Charnwood Forest, already cited (from the *Phil. Mag.*) in our last No. but one, p. 115, with respect to the attempt to discover coal at Billesdon Coplow, that geologist briefly considered the date of the elevation of the Charnwood Forest ridge, and the effects produced by it on the neighbouring country. In the first place, he showed by sections, that the forest ridge had been elevated, and that many of the valleys belonging to its actual configuration, existed prior to the deposition of the new red sandstone, secondly, from the position of five highly inclined masses of mountain limestone appearing on a

line drawn from Bredon to the north-west corner of the Forest ridge, that the movement of elevation was posterior to the deposition of the carboniferous series. In short, the five masses above mentioned were stated to dip under the Ashby-de-la-Zouch coal field, and their position to be perfectly accounted for by the prolongation of the anticlinal line which, as described in the second part of the communication, ranges from the neighbourhood of Bradgate Park in a direction about north-west, through the longest diameter of the district. Still further to the N. W. the forces of elevation connected with the anticlinal line seem to have produced no sensible effects, as the limestone at Ticknall in Derbyshire, is nearly horizontal. Lastly, the author expressed his opinion that the coal field of Nuneaton had been elevated by an undulation of the lower strata parallel to and probably of the same date with Charnwood Forest, and that both these elevations were probably of the same epoch with the disturbing forces which threw up the transition limestone and coal measures of Staffordshire, and produced the configuration of the great coal fields in the south-western parts of England.

Outline of the Geological History of Common Salt. By Mr. Brayley, Jun.—From the circumstance that in England deposits of mineral chloride of sodium, or rock salt, are confined to the formation called by geologists the new red sandstone, it was inferred that this formation was the peculiar repository of mineral salt in the earth's crust; and even the known occurrence of mineral salt in distant countries was held to be sufficient evidence of the existence of the new red sandstone in them, when nothing further was known of their geology. But within these few years it has been found that either deposits of rock-salt, or brine-springs (which must derive their origin from beds of that substance acted upon by water) occur among rocks of almost all ages. This is what we might expect, indeed, from the collective tenour of all the facts of geology; for as the remains of marine animals are found in strata of every geological epoch,—from the period of the transition rocks at which organized beings appear first to have come into existence, down to those of the most recently formed deposits,—it is clear that the sea must have existed throughout the entire period from the formation of the transition rocks to the present time. And if the sea existed, it must necessarily have happened that its saline contents would be deposited in a solid form, more or less, during the production of every class of rocks. Accordingly, in certain parts of the United States, salt or brine-springs are stated by Mr. Featherstonhaugh to issue from old *transition* slate-rocks. In the English coal measures are several copious salt-springs. The rock-salt of Cheshire, and the salt-springs (which are known to issue from beds of the same substance) of Worcestershire, are situated in the new red sandstone

belonging to the *secondary* rocks. In Wurtemberg, Alberti has proved rock-salt to exist in the upper members of the same series, called the *Keuper* and the *Muschelkalk*. In Switzerland, Mr. Bakewell places it in the lias, a formation which succeeds the new red sandstone, in the ascending order. In the Austrian Alps, Messrs. Sedgwick and Murchison have shown it to occur in the upper oolites, still higher or more recent, in the order of geological formations. The salt deposit of Wieliczka, near Cracow, constitutes a portion of the strata more recent than the chalk, and belonging therefore to the *tertiary* series. And,—to bring down the deposition of common salt in the earth to the present time,—in the Crimea it is said to be daily accumulating in inland lakes. These facts constitute an outline of the geological history of common salt, the substance in which the largest proportion of the base of the alkali soda occurs in nature, and from which, therefore, the largest proportion of the alkali itself is obtainable.—*Parkes's Chemical Catechism, by Brayley*. P. 171—2.

LIST OF NEW PATENTS.

John Ramsey, of Caroline Place, Mecklenburgh Square, in the county of Middlesex, Esq. for certain improvements in apparatus for turning over the leaves of music and other books.—Sealed February 26, 1834.—(*Six months.*)

Vincent Nolte of Bridge Street, Blackfriars, in the city of London, Esq. for an improved hydraulic power engine.—Sealed February 27, 1834.—(*Six months.*)

James Smith, of Deanston Works, in the parish of Kilmadock, in the county of Perth, Cotton Spinner, for certain improvements in machinery for carding cotton, flax, wool, silk, and other fibrous materials.—Sealed February 27, 1834.—(*Six months.*)

James Duffield Harding, of Gordon Square, in the the county of Middlesex, Artist, for certain improvements on pencil, pen, and chalk cases or holders.—Sealed February 27, 1834.—(*Six months.*)

Joseph Whitehorn, of Manchester, in the county palatine of Lancaster, Machinist, for certain improvements in machinery or apparatus for cutting screws.—Sealed February 27, 1834.—(*Six months.*)

Robert Hendrick Goddard, of Woolwich, in the county of Kent, Gentleman, for certain improvements in

the construction of weighing-machines, and in the mode, manner, or method of ascertaining, registering, and indicating the number of operations or quantity of work performed by weighing, measuring, or numbering apparatus or machines.—Sealed February 27, 1834.—(*Six months.*)

Thomas John Fuller, of the Commercial Road, in the county of Middlesex, Civil Engineer, for an improvement or improvements in machinery or apparatus for making or manufacturing of nails.—Sealed February 27, 1834. —(*Six months.*)

William Augustus Archbald, a Lieutenant in his Majesty's Navy, at present residing at the Tavistock Hotel, Covent Garden, in the county of Middlesex, for a certain improvement in the making of sugars.—Sealed February 27, 1834.—(*Six months.*)

Henry Pinkus, late of Pennsylvania, in the United States of America, now of North Crescent, Bedford Square, Gentleman, for an improved method of, or apparatus for, communicating and transmitting or extending motive power by means whereof carriages or waggons may be propelled on railways or common roads and vessels may be propelled on canals.—Sealed March 1, 1834.—(*Six months.*)

Thomas John Fuller, of the Commercial Road, in the county of Middlesex, Civil Engineer, for an improvement in the shape or form of nails, spikes, and bolts.—Sealed March 6, 1834.—(*Six months.*)

William Morgan, of the Kent Road, in the county of Surrey, Esq., for improvements in certain kinds of steam engines.—Sealed March 13, 1834.—(*Six months.*)

John Augustus Manton, late of Calcutta, in the East Indies, but now residing with his Brother at the Small Gun Office, in the Tower of London, Gun Maker, for certain improvements in fire arms.—Sealed March 13, 1834.—(*Six months.*)

John Isaac Hawkins, of Pancras Vale, in the county of Middlesex, Civil Engineer, for certain improved instruments for facilitating the cure of disease by administering galvanic influence into the human body.

Communicated by a foreigner residing abroad.—Sealed March 13, 1834.—(*Six months.*)

James Jamieson Cordes, of Idol Lane, in the city of London, Merchant, for a certain improvement or improvements in machinery for making rivets and screw blanks or bolts. Communicated by a foreigner deceased.—Sealed March 18, 1834.—(*Six months.*)

James Jamieson Cordes, of Idol Lane, in the city of London, Merchant, for a certain improvement or improvements in machinery for making nails. Communicated by a foreigner deceased.—Sealed March 18, 1834.—(*Six months.*)

Samuel Slocum, of the New Road, St. Pancras, in the county of Middlesex, Engineer, for a certain improvement or improvements in machinery for making nails.—Sealed March 18, 1834.—(*Six months.*)

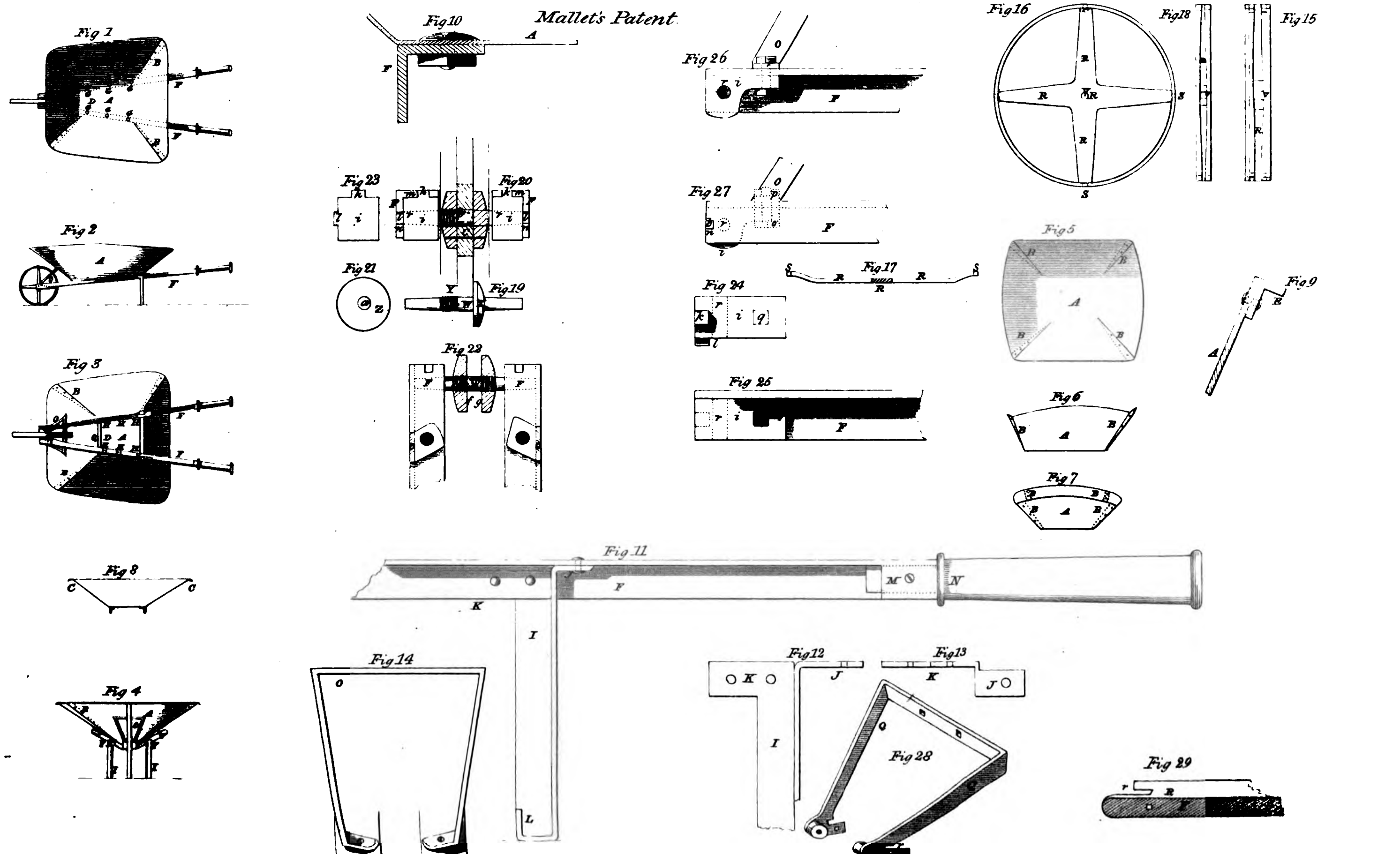
Samuel Slocum, of the New Road, St. Pancras, in the county of Middlesex, Engineer, for improvements in machinery for making pins.—Sealed March 18, 1834.—(*Six months.*)

John Paterson Reid, of the city of Glasgow, Merchant, and Thomas Johnson, of the same place, Mechanic, for certain improvements applicable to certain looms for weaving different sorts of cloth.—Sealed March 20, 1834.—(*Six months.*)

Henry Crane, of Wolverhampton, in the county of Stafford, Merchant, and John Young, of the same place, Patent Lock Manufacturer, for certain improvements in the making or manufacturing and forming of iron for hoops of casks, and other purposes.—Sealed March 20, 1834.—(*Six months.*)

Thomas Baker, of No. 19, Upper Stamford Street, in the county of Surrey, Gentleman, for certain improvements in the construction or mechanism of chronometers, watches, and clocks; and which may also be applicable to other mechanical purposes. Communicated by a foreigner residing abroad.—Sealed March 20, 1834.—(*Six months.*)

Mallet's Patent.



THE

REPERTORY

OF

PATENT INVENTIONS.

No. V. NEW SERIES.—MAY, 1834.

Specification of the Patent granted to WILLIAM MALLET, *of Marlboro' Street, in the city of Dublin, Ireland, Iron Manufacturer, for certain Improvements in Making or Constructing certain descriptions of Wheel-barrows.*—Sealed August 5, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said William Mallet, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawing hereunto annexed, and the following description thereof (that is to say):

Description of the Drawing.

In the said drawing, fig. 1, is a plan of a wrought iron wheel-barrow.

Fig. 2, a side view thereof;

Fig. 3, an under view; and

Fig. 4, an end view of it; in all of which said figures the same parts are designated by similar letters of re-

ference, as well also in the other figures to be hereafter referred to. A, is the body, bowl, or pan, to contain the materials to be conveyed upon the barrow; this body is made of one piece of sheet or plate iron, cut externally or around, to the shape or size required for the various purposes to which the barrows may be applied; for instance, for the use of miners, road makers, canal, or other excavators, farmers, or gardeners; and made thicker or thinner, according to the probable weight of the materials to be carried thereon. The body shewn in these four figures, is intended for such barrows as are to be used in road or canal works; whilst that shewn in plan in fig. 5, sideways in fig. 6, and endways in fig. 7, is intended for the use of gardeners or farmers, and is therefore made thinner and lighter than the former one; they may, however, be made of any other forms required.

The manner of making the said bodies, bowls, or pans, is as follows. The external size being ascertained, I make, by means of shears, or otherwise, in each sheet or plate of iron, from the extremities, or where the angles in the bodies of wooden wheel-barrows would be, that is, where the sides would join the fronts or ends, as well as to the bottoms, I then, by means of a falling weight or dies, such as are used by platers or stampers of embossed figures in metal, or by a screw press, or other sufficient power, with similar dies, form the body to its required shape; and in so doing the parts of the sheet or plate-iron overlap at the angles, or curved turns, and thus give double the strength to those parts which are the most liable to injury in use, namely, the front angles, or curved turns at the top, by their striking against the ground in oversetting the barrow to discharge its load. I, however, in those cases where the sides or ends of the barrow are more upright, or do not spread or extend outwardly in so great a degree, also cut out a piece of the iron at the corners, for the sake of lightening the barrow, still, nevertheless, retaining a sufficient quantity of it to overlap,

and to be rivetted together, in the manner shewn at B, in the different figures. I likewise turn the edge or rim a little outwards, as shewn at C, C, in the section, fig. 8, which also considerably increases the strength of the body. I carefully avoid the formation of angles where the sides join the front ends and bottom of the body; this is done not only to increase its strength, but also to prevent the lodgement of any water in the bottom; in further prevention of which I also pierce a few holes, with their burs downwards, in that part of the body which is the most depressed, as at D, in figs. 1 and 3, in order that the water may flow out, without spreading over the bottom, and thereby creating rust. I can also, if thought desirable, strengthen the edges or rims of these bodies, by rivetting a border of angle-iron around them, as shewn in section, on a larger scale, in fig. 9, at E. In order to mount or affix these bodies upon their frames or supports, I make holes through their bottoms, by the help of gauges, to exactly match other holes made in angle-iron, of which iron I form the main side-bars, or supports, of their frames. In figs. 1, 2, 3, 4, and 8, F, represents these side-bars made of such angle-iron as is used in making boilers; that which I have used is from one inch and three quarters to two inches broad on each side, and a quarter of an inch in thickness.

In fig. 10, F, represents a section of such angle iron, of its full size. A, a section of part of the body of a wheel-barrow bound to the side bar F, by the screwed broad-headed pin or bolt G, having a square shoulder, and provided with a screwed nut, H, G, in fig. 1, and H, in fig. 3, indicate these screws and nuts: the screws being passed through the square holes made in the body of the wheel-barrow and through the corresponding holes formed in the angle-iron to receive them. I can, however, if preferred, attach the bodies to the frames by pins or rivets instead of screws and nuts. I may here remark, that the angle iron unites the greatest lightness with the greatest

strength, in its application to the support of the bodies of wheel-barrows, as well as to the formation of the legs of it, and their attachment to the side-bars of the frame.

In fig. 11, F, represents an inner view of part of the right-hand side-bar; and I, one of the legs formed, as above-mentioned, of angle-iron, and which, being cleft at one of its ends through the angle, has one side bent at a right-angle flat-ways, as shewn at J, and the other side bent at a right-angle edgeways, as shewn by dotted lines at K, in that figure, but still better in the separate figure of the upper part of the leg, fig. 12, and in an end view of it, fig. 13. The leg thus prepared is then firmly affixed to the inside of the side-bar F, by rivets passed through holes to receive them, and as shewn in fig. 11, the other leg being affixed to the opposite rail or side-bar in a similar manner, but in the reverse position of course. The legs may also be screwed to the bodies of the wheel-barrows if required, in a similar manner, by rivetting. The lower ends of the legs being also cleft in the angle, I cut a small piece off one side of each leg equal to the square of the angle-iron, and I then bend up the corresponding part of that cut off, in the manner shewn at L, in fig. 11, to form feet to the legs. I also form a square socket at the hinder end of each side-bar, as shewn at M, in fig. 11, by bending and welding the iron, in order to receive into each a wooden handle N, which may be secured therein by a screw, as shewn, or otherwise. The manner of mounting the wheel to the front ends of the side-rails, will be described hereafter. I also unite the bodies of my wheel-barrows with the front ends of the side-rails, by means of the staple-stay O, shewn edgeways in fig. 2; as viewed beneath in fig. 3; and endways in fig. 4. It is likewise shewn endways on a larger scale in fig. 14, the stay being rivetted or screwed to the front of the body, as shewn in figures 3 and 4; it is likewise secured to the front ends of the side-rails by means of screwed bolts passed through the same holes, which

likewise secure the iron bushes in their places, for the axle of the wheel to turn in, as will be described hereafter, and through holes formed in the lower ends of the staple-stay, as shewn at P, P, in fig. 14. This staple-stay may either be made of flattened iron, one inch wide and a quarter of an inch thick; or of round or bolt-iron, half an inch in diameter, and made flat where it is joined to the body of the barrow; as well also where it is united with the two side-rails; or it may be made of angle-iron, three quarters of an inch broad on each side and an eighth part of an inch in thickness. Other forms or sizes of iron may also be used, but I give the preference to the above-mentioned ones. Or I make the staple-stay of the shape shewn at Q, fig. 28, in which case the carriages, boxes, or bushes, for the axis of the wheel to play in, are welded to the stay, and fastened, as before described, to the body, but in place of the stay being fastened to the top of the sides, as before described. It is bolted to the sides or upright part of them, grooves being cut in the tops of the angle-iron sides *r*, *r*, in front of the barrow, as shewn at R, fig. 29, and corresponding grooves being also cut in the part of the stays which join the sides, and into which grooves the stays are then slid, and locked into each other, and when home to their places, the bolt-holes in the sides of the stays correspond exactly with those in the sides, through both of which the bolts or rivets to connect and keep the stay and sides together pass; and thus in a very simple manner the greatest possible strength is given to the stay, the sides, and the body of the barrow. It will be seen that the carriages, boxes, or bushes, for the axis of the wheel in this mode of construction are considerably deeper or thicker than the thickness of the stay. I make them about an inch and a half deep for the bearing of the axis, on each journey. The axis is prevented from shifting either way, by the upright parts of the sides, and by being the exact length so as to fit precisely between them. I can also occa-

sionally strengthen the frame of the barrow by adding the two cross bars shewn at Q, Q, in fig. 3, which may be secured in their places, by having the screwed pins or bolts which affix the body of the barrow to the side-rails, also passed through holes made in the ends of the cross-bars to receive them. I form the wheels for these barrows of wrought iron, in the following manner. The rims of the wheels for such barrows as are intended to be used in canal or road-making may be narrow, as for instance, from an inch to two inches wide on the face, and about half an inch in thickness; whilst those intended for barrows for the use of farmers or gardeners may be from two to three inches wide; and for this latter purpose, and in order to have the rim of the wheel as light as possible, I employ iron made as in the section of a wheel shewn in fig. 15, thicker in the middle, for instance, a quarter of an inch only thick at its outsides, and half an inch thick in the centre, where the holes to receive the spokes of the wheel are to be made. These holes are to be made, at proper distances apart, by the action of a press, regulated by gauges, previous to uniting the ends of the rim by welding them; after which, the rim must be made of a truly circular shape. The arms or spokes of the wheel are made in the following manner. The cross-arms being forged in one piece, and a hole made in their centre, as shewn in fig. 16, at R, V, for the axis to be passed through; the arms are to be cut of equal lengths, and formed with shoulders and tenons at their ends, proper for rivetting in the holes made to receive them in the rim, and as shewn by the dotted lines at S, in fig. 16. The cross arms are then to be bent so as to contract them in length, sufficiently to permit the tenons to enter the holes made in the rim, and as shewn in the section, fig. 17; after which they are again to be flattened in proper tools, and be extended to their full length, and then firmly rivetted into the holes. The wheel will then appear as shewn in fig. 16, and in section

in fig. 18, T, being the rim of the wheel. The broader rim is shewn in section at U, in fig. 15. The rim and arms or spokes of the wheel being thus united, and a circular hole, V, made in the centre of the arms or spokes, as before mentioned, to receive the axis, I now proceed to describe the method I have adopted in constructing it. The axis, W, figs. 19 and 20, is forged of iron, with a round collar, X, upon it, to fit against the flattened central part of the arms or spokes of the wheel; the part W, of it is made cylindrical, to fit the circular hole V, formed as above-mentioned, to receive it; and the part Y, fig. 19, adjoining to the said cylindrical part, W, is screwed, and has another collar, Z, figs. 20 and 21, made with a screwed hole, *a*, to fit the screwed part Y, of the axis, affixed upon it; the arms or spokes of the wheel being thus confined between the two collars X, and Z, when the latter is screwed close thereto, and as shewn in fig. 20; the collar Z, is prevented from becoming screwed by means of a pin *b*, figs. 19 and 20, which is driven through holes formed in the collar and axis to receive it, and which said pin is secured therein by rivetting or otherwise. The wheel being thus placed upon its axis, it may be still further fixed, and prevented from turning or loosening upon the axis, by passing a cross-pin *c*, fig. 20, through holes made in the collars and arms to receive it, and securing it therein in the above manner. Or, instead of forging a round collar upon the axis, in the manner above described, I can form a right and left threaded screw upon the axis, as is shewn at *d*, and *e*, in fig. 22, and fit two collars *f*, and *g*, with corresponding screwed holes in them, thereto; and between which said screwed collars the arms or spokes of the wheel may be confined, and be secured by pins passed through the collars and axis, and by a cross-pin, in the manner above-mentioned. The collars, the axis, and the faces of the arms or spokes, are all formed in dies, and turned and bored truly, so as to cause their surfaces to fit accurately together, parallel

to each other, and square to the line of the axis of the wheel; and the journeys, pivots, or axis, *h*, *h*, fig. 19, at each end of the axis of the wheel, are likewise formed in dies, turned so as to fit the holes in the iron bushes (to be hereafter described), and case-hardened by any of the usual and well-known processes, to increase and preserve their durability. The iron blocks, bushes, or carriages, *i*, *i*, &c. figs. 20 to 27, in which the axes of the wheel turn, have holes made in them to fit those axes accurately; and they are likewise case-hardened, for the reasons above mentioned. These bushes or carriages are iron blocks, one of which is shewn endways in fig. 23, in plan, or as viewed from above in fig. 24, and as viewed sideways in fig. 26, made to fit the inside of the angle-iron F, accurately, as shewn in fig. 20; and each having two projecting studs formed upon it, *k*, and *l*, the former in the front and the latter in the side of each block. The studs *k*, *k*, are accurately fitted into corresponding gaps *m*, *m*, made to receive them in the front ends of the upper surfaces of the angle-iron main side-bars of the wheelbarrow; and the studs *l*, *l*, are also accurately fitted into other corresponding gaps *n*, *n*, prepared for them, in the outsides of the said main-side-bars, and as likewise shewn in fig. 20. They are thus supported endways and sideways, but they are besides firmly retained in their places by means of screws and nuts *o*, and *p*, fig. 26. The screws having square shoulders close to their heads, which are passed through square holes, *q*, *q*, formed in the blocks to receive them, as shewn in figs. 24 and 25; and also through round holes made in the upper surfaces of the angle-iron main side-bars; and also through the lower ends of the staple-stay O, as shewn in figs. 14, 22, 26, and 27; and which said screwed nuts being firmly bound, the two main side-bars F, F, the two iron blocks *i*, *i*, and the staple-stay O, are all united together.

Fig. 27, is an outside view of the front end of one of the iron main side-bars; the block, screw, and nut, being

shewn by dotted lines. *r*, in fig. 26, is an end view of one of the holes which are made in the iron blocks, or bushes, to receive the axes of the wheel; and which holes are shewn longitudinally by dotted lines at *r*, *r*, in figs. 20 and 22, and endways at *r*, in fig. 27.

Having thus shewn and described my method of making or constructing wheel-barrows of wrought iron, having also wrought-iron wheels, I hereby declare that I do not mean or intend hereby to limit or confine myself to the making the bodies, bowls, or pans thereof, in the manner herein described, as I can shape them of an entire sheet of iron, when red-hot, by means of stamps, dies, or presses, without cutting them and rivetting them at the corners. Neither do I mean to limit myself to the employment of such angle-iron as I have herein shewn and described; but also to use such whose sides may form any angle whatever. Neither do I intend to limit myself to the use of any particular kind of screws, rivets, or bolts, in combining the different parts together; but to use any which are fit and proper for the purpose. Nor do I intend to confine myself to the making of wheel-barrows to the form shewn, but to vary them according to their required purposes. These wrought-iron wheel-barrows, from their construction, will, I believe, be found to be both lighter and stronger than any iron wheel-barrows which have been heretofore in use; and, when painted and kept dry after use, they will last much longer than wooden ones; and, consequently, will be found more durable and cheaper than such wheel-barrows, or even than the iron wheel-barrows which have hitherto been made.—In witness whereof, &c.

Enrolled January 18, 1831.

Specification of the Patent granted to CHARLES TAVERNER MILLER, *of Piccadilly, in the County of Middlesex, Wax Chandler, for certain Improvements in Making or Manufacturing of Candles.*—Sealed February 14, 1830.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I the said Charles Taverner Miller, do hereby describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, by the following description thereof (that is to say);

My invention relates to wax, spermaceti, and composition candles, and consists of a glass ring being introduced round the wick at the neck of each candle, thereby forming a fence round the wick.

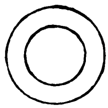
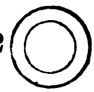
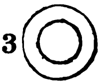
In the manufacture of wax candles I introduce the ring by passing it over the top, and putting it on the neck of the candle at the half-making, and in other respects these candles are to be made in the usual manner.

With respect to the spermaceti and composition candles, the mode of introducing the ring is as follows: I cotton the frames in which the candles are made in the usual manner. I then put a ring round each wick at the top part of the frames; that is, at the part which forms the bottoms of the candles. When the frames are turned down, the rings fall to the bottoms of the pipes, that is, to the parts which form the tops of the candles, and when the melted ingredient is poured in the ring, will be properly fixed in the neck of the candle.

In the spermaceti and composition candles I use the platted wicks, which are now in general use, but I do not claim this kind of wick as my invention.

The rings which I use are made of solid round glass, and I use three sizes, designated as under by the numbers

1, 2, 3. No. 1, the largest, I use for short twos. No. 2,

No. 1  No. 2  No. 3 

for long twos and short threes, and for all candles of the same thickness; and No. 3, for all candles not so thick as short threes.—In witness whereof, &c.

Enrolled August 2, 1830.

Specification of the Patent granted to James Chesterman, *of Sheffield, in the county of York, Mechanic, for certain Improvements on Machines or Apparatus for Measuring Land and other Purposes.*— Sealed July 14, 1829.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.— *Now know ye,* that in compliance with the said proviso, I, the said James Chesterman, do hereby declare the nature of my said invention to consist in what is commonly called a measuring tape, in which the cylinder or barrel on which the tape is wound is connected with a strong watch or clock spring, according to the size required, in such manner as to wind up the tape after it has been drawn out without any effort on the part of the operator. And in further compliance with the said proviso, I, the said James Chesterman, do hereby describe the manner in which my said invention is to be performed, by the following description thereof, reference being had to the drawing annexed, and to the figures and letters marked thereon (that is to say);

Description of the Drawing.

Fig. 1, represents one of my improved measuring

machines of a short length, as, for instance, a yard, for which length a simple attachment of the cylinder or barrel on which the tape is wound to an ordinary strong steel spring is sufficient, as here shewn. A, is the outer case of the machine; B, the cylinder to which the tape is fastened, and which forms also the box of the spring; C, the stud to which the spring is attached, being also the axis on which the cylinder turns; D, the spring coiled round in the box; E, the tape and loop to pull it out by; F, two rollers between which the tape passes; I, a small bolt which pushes the tape against one of the rollers, and thus stops it at any given length till the bolt is withdrawn.

Fig. 2, is a section of fig. 1, in which similar letters are used to denote similar parts. G, is a top or cover screwed down upon the case over the works, to keep the same in their places when the spring is in action.

Fig. 3, represents one of my improved measuring machines of a larger size, and a greater length of tape, for which it is necessary to provide that the tape shall wind up on the cylinder faster than the spring unwinds from the stud or axis, otherwise the spring would be of an inconvenient length; this is effected by an arrangement of cogged wheels or racks and pinions, as here shewn. A, is the outer case of the machine; B, the cylinder on which the tape is wound, and which, in this case, is separate from the box, which holds the spring; D, is the spring lying coiled in its box, and it will be seen that the box is furnished inside its upper rim with a rack or cogs, which take into the cogged wheel at C, which, in its turn, takes into the pinion, E. This pinion is fixed to the four arms of the tape cylinder, B, the axis of which pinion serves to form a stud to fasten the inner end of the spring to the arms. H, H, C, serve to keep the spring in its place while in action. The rest of the apparatus is the same as figure 1. Now it will be seen by this arrangement, that while the tape is drawing out or off the cylin-

der, B, the pinion, E, will act upon the cogged wheel at C, which cogged wheel, taking into the rack inside the spring-box will wind the spring slowly up, and the cylinder will thus perform several revolutions to one of the spring-box. If the tape then be released, the rack attached to the spring-box, communicates motion to the cogged wheel at C, and thence to the pinion, E, which winds up the tape with the same relative velocity.

Fig. 4, is a section of fig. 3, in which G, represents the cover or top of the machine, which part is supposed to be removed in figs. 1 and 3, for the purpose of better shewing the mechanical arrangement of the machine.

Now whereas, it is evident that this instrument is susceptible of various modifications both as to material and arrangement. But whereas, I claim as my said invention, the application of a spring to make it a self-winding instrument, together with the application of two speeds in order to make the sort of spring here shewn answer for long tapes, and also the adjusting-bolt, I; and such my invention being, to the best of my knowledge and belief, entirely new and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland called England, his said dominion of Wales or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve or disguise with the proviso in the said hereinbefore in part recited letters patent contained; wherefore, I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled January 9, 1830.

Specification of the Patent granted to WILLIAM TAYLOR, *of Wednesbury, in the County of Stafford, for certain Improvements on Boilers and Apparatus connected therewith, applicable to Steam Engines and other purposes.*—Sealed July 19, 1830.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said William Taylor, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed are particularly described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

My invention consists, first, in improvements applied to a boiler for the purposè of supplying the water thereto. Secondly, in an improvement, whereby the deposition of sediment in boilers may be got rid of whilst the boiler is at work; and, thirdly, in improvements applied to the furnace and chimney whereby I am enabled more perfectly to burn the smoke, I will now proceed to describe the drawing hereunto annexed, in which is represented a means of carrying each of my said improvements into effect.

Description of the Drawing.

Fig. 1, represents a longitudinal section of what I call the water-supply vessel, it being the vessel into which the water first enters prior to its being admitted into the boiler; this figure also shews part of the section of a boiler, for the purpose of shewing the manner of applying the water-supply vessel to a boiler. A, is the water-supply vessel. B, the boiler. C, the water-pipe, which descends from the vessel, A, into the boiler, and it is by this pipe, C, that the boiler is supplied with

water from the vessel, A. D, is a pipe ascending from the top of the boiler into the vessel, A, which pipe is for the purpose of conveying steam from the boiler to the top or above the surface of the water contained in the vessel, A, the purpose of which will hereafter be more particularly described. E, is a cock on the pipe, C; and F, is a cock on the pipe, D, which cocks are open and shut by the handles, *e* and *f*, in each of which handles there is a slit cut for receiving and permitting to slide a stud fixed on the rod of the float, which regulates the quantity of the water supplied to the boiler. G, is the float; and H, the rod ascending therefrom. I, is a pipe by which the water-supply vessel is filled, either by means of a pump or from a reservoir; on which pipe, I, there is a valve, M, opening inwards, as shewn in the drawing.

Having now described the various parts represented in this figure, I will describe the manner of their action. In doing which I will suppose that the water has been forced or flowed into the vessel, A, and that that vessel is full; such being the case, when the water-line in the boiler becomes lowered, the float, G, will follow, and by means of the rod, H, will draw down the handles, *e* and *f*, of the cocks, E and F, placed over the pipes, C and D, by which means the steam will be permitted to flow up the pipe, D, to the top of the vessel, A, which will equalize the pressure in the vessel, A, and the boiler, B, when the water will descend through the pipe, C, into the boiler till the level of the water in the boiler has arrived to its proper height, which will raise the float, G, and close the cocks, E and F. I would here observe, that when the pressure of the steam is acting in the vessel, A, the valve, M, will be closed, and thus prevent the water being driven out at the pipe, I, but so soon as the cocks, E and F, are closed the pressure of the steam will be stopped in the vessel, A, and thus permit the water to flow into and again fill this vessel.

Having now described the first part of my invention, I

would have it understood that what I claim is the application of a separate vessel similar to that described as the water-supply vessel, A, when the water is supplied therefrom by the steam from the boiler, being permitted to flow into and equalize the pressure, and thus allow the water to flow into the boiler as above described.

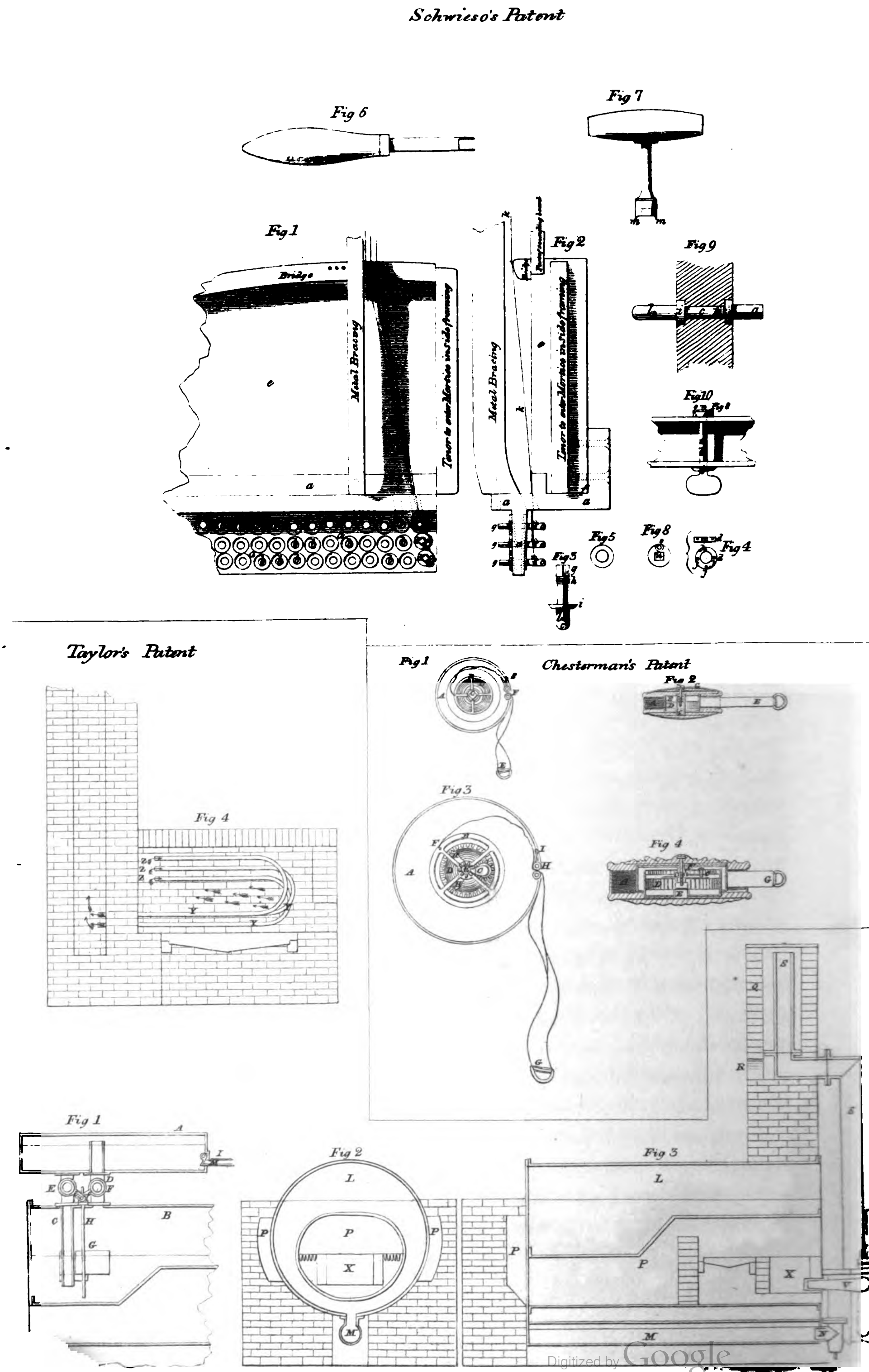
I will now describe figs. 2 and 3, which represent a means of getting rid of the deposition or sediment whilst the boiler is working. L, is the boiler, and M, is a recess or smaller vessel connected to the bottom or lower part of a steam-boiler in the manner shewn in this figure. N, is a pipe connected to the vessel, M, having a stop-valve or cock thereon, so it will be evident, that as the deposit will be continually taking place in the vessel, M, if the cock of the pipe, N, is opened, the pressure in the boiler will force out such deposit or sediment through the pipe and valve, N, and thus may the deposit be got rid of from time to time. I would here observe that the vessel, M, should always be placed in such a position as at all times to contain the coldest particles of the water, which in boilers having the fire within them will always be at the bottom, as is shewn in the drawing, but in boilers where the fire is made to act on the outer surface of the bottom of the boiler, the vessels, M, must be placed on each side of the boiler, and protected from the action of fire, as it is necessary that the vessels, M, should at all times contain the coldest part of the water of the boiler. Now I would have it understood that I am aware that boilers or salt pans have been made with troughs or vessels protected from the action of the fire, and thereby such troughs or vessels contain the coldest part of the matters boiled in such vessels, but I lay no claim to such salt pans or boilers for making salt, when so constructed, they being already known. But what I claim is, the application of the vessel, M, and the valve or cock, N, to the boilers of steam engines, for the purpose of getting rid of the sediment in the manner above described, and which, as afore-

said, forms the second part of my invention. Figs. 2 and 3, also shew part of my improvements in the apparatus applied to the furnace of a steam boiler; L, being the boiler; P, P, the flues passing through and around the boiler; Q, the chimney, which is closed at the top. R, is an outlet placed at some distance from the top of the chimney. S, is a pipe connected to the top of the chimney, which pipe, S, descends to an exhausting and blowing apparatus, having a valve placed at the lower end, opening into the cylinder of the blowing apparatus. V, is a pipe leading from the exhausting and blowing apparatus, W, through the ash-pit, and into the recess or well, formed under the bars of the fire place at X, which recess or well is shewn as constructed of fire bricks, and is open at top into the fire place, whereby it is at all times filled with coals, and at the bottom it is sufficiently open to permit of the ashes being raked out, but which ashes are always to be kept sufficiently above the opening at the bottom of the well, X, to prevent the smoke which is forced through the pipe, V, being driven in any other direction than upwards through the burning coal, as will be fully described hereafter.

Having now described the parts represented in this figure, I will proceed to describe the manner of their action. The fire being lighted, the smoke will pass along the flues, P, P, and thence into the chimney, Q, from whence it would pass out into the atmosphere through the outlet, R, but that it is prevented by the working of the exhausting and blowing apparatus, W, which will cause the smoke to pass through the pipe, S, into the cylinder, W, whenever the piston in such cylinder is raised, and the return stroke of the piston will force the smoke so withdrawn from the chimney through the pipe, V, into and through the burning coal, and thus will the smoke be continually forced through the fire. But in order to have a continued action of the blowing-apparatus in withdrawing and forcing the smoke, it will either be necessary to have

two cylinders working in succession, or to have a closed cylinder, the pipes, S and V, being connected with the top and bottom of such cylinder, as is well understood in making exhausting and blowing apparatus. It will be necessary here to observe, that as the black and dense smoke is only evolved at, and a short time after, the putting on of fresh coal, it will only be necessary to work the exhausting and blowing apparatus so long as such dense smoke is evolved; this apparatus must therefore be attached to the engine in such a manner as readily to be put into and out of geer, and when disconnected from the engine, sufficient draft will be kept up by the outlet, R, but in case there be a feeding apparatus applied to the furnace, whereby a continuous supplying of coals is kept up, then the exhausting and blowing apparatus should be kept in continued action.

Fig. 4, shews another plan of consuming the smoke in furnaces, and consists in passing a pipe or pipes through the heated coal, in such a manner that the smoke evolved must pass through such heated pipes, and thus will the smoke be consumed. Y, Y, Y, are three pipes opened at their ends, Z, Z, Z, being opened for the passage of the smoke and heated air, which not being able to find vent at any other part of the furnace are obliged to pass down through the pipes, Y, Y, Y, which being red hot destroys the smoke, but sufficient draft is kept up for the fire by the other ends of the pipes, Y, Y, Y, being open to the chimney, as shewn in the drawing. Now I would have it understood, that what I claim as this third part of my invention, is, the application of an exhausting and blowing apparatus to the chimney, such chimney being open to the atmosphere, for the purpose of withdrawing the smoke therefrom, and forcing it again through the fire as above described; and I also claim the passing of a pipe or pipes in the manner above described through the burning coal, whereby the smoke evolved by such coal, shall, from having no other vent, be obliged to pass



London . Simpkin & Marshall . for the Proprietors May 1 1834.

through such heated pipes, and thus destroy or burn the smoke so evolved.—In witness whereof, &c.

Enrolled January 17, 1831.

Specification of the Patent granted to JOHN CHARLES SCHWIESO, *of Regent Street, in the County of Middlesex, Musical Instrument Maker, for certain Improvements in Piano-Fortes and other Stringed Instruments.*—Sealed February 2, 1831.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said John Charles Schwieso, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say);

My invention relates to the tuning pins, and the manner of applying the same to piano-fortes and other stringed instruments, and whereby the proper tension may be more readily obtained and kept to the strings of such instruments.

Description of the Drawing.

Fig. 1, represents part of what I call the rest-plate, which is made of cast-iron, and is affixed to the rest-plank, which bears the power or stretch of the strings of the instrument. Heretofore the tuning-pins have been applied to the rest-plank, but by my improvements I am enabled to apply the pins to a strong metal-plate, *a*, which forms part of the rest-plank, and thus strengthens and is of the same length with it. I am now speaking with reference to applying my improvements to piano-fortes, which I will first describe; and afterwards their applications to other stringed instruments.

In each of the figures in the drawing the same letters refer to similar parts; *a*, fig. 1, being the iron plate or rest-plate, running from side to side of the piano-forte, and through this plate, *a*, the holes, *b*, *b*, *b*, are drilled, for the purpose of receiving the tuning-pins, *c*, *c*, *c*, in the manner hereafter described; these holes, *b*, *b*, *b*, have counter sunk recesses on each side for the purpose of receiving the binding or friction collars, *d* and *i*, which are affixed to the tuning-pins, *c*, *c*, *c*.

Fig. 2, is an edge view of the rest-plank, *e*, and plate, *a*, affixed thereto by means of screws and the rabbet or groove, *f*, formed or cast in the metal-plate, *a*, to receive the edge of the rest-plank, *e*, as shewn in the drawing.

Fig. 3, shews one of the tuning-pins, *c*, separately, having a fixed collar, *i*, a square head, *g*, and a screw, *h*.

Fig. 4, represents another collar, *d*, having a female screw cut therein to fit the screw on the tuning-pin, *c*. By this figure it will be seen, that at the top of this collar, *d*, there are four holes, *j*, drilled for the purpose hereafter described.

Fig. 5, shews one of two leather washers, which are placed one on each side of the rest-plate, *a*, and it is by the binding of the collars, *d* and *i*, on these washers which produces the proper friction for holding the tuning-pins in whatever position they are brought by turning them by the key for the purpose of tuning the strings.

In the drawing I have not thought it necessary to shew a piano-forte, because the application of my improvements will be well understood by any competent workman. The part of the rest-plank, *e*, and rest-plate, *a*, here shewn, are for a grand horizontal piano, and has three strings to each note, and consequently three tuning-pins, *c*, *c*, *c*, one to each string, and in the drawing I have only represented one set of strings proceeding from three pins, which are drawn in their proper places. The strings, *k*, *k*, *k*, are passed through the holes, *l*, *l*, *l*, of the tuning-pin, *c*, in the usual manner, and thence through the hole

drilled in plate, *a*. In order to put the tuning-pins into their places in the rest-plate, *a*, the square head, *i*, is to be passed from the underside through the holes drilled in the plate, *a*, having first placed over the collar, *i*, one of the leather-washers, and the other washer is to be placed in the top of the plate, *a*, and then the collar, *d*, is to be screwed on to the screw, *h*, of the tuning-pin, *c*, by means of the instrument, fig. 6.

The two projecting points of that instrument, taking into two of the holes, *j*, *j*, drilled on the top of the collar, *d*, by which means it will be screwed down tightly on to the washer on the under side thereof, which will bring the two collars, *d* and *i*, to bind tightly on the plate, *a*, and thus will sufficient friction be obtained for keeping the pin, *c*, to any position to which it may afterwards be turned by means of the tuning-key, fig. 7, which is formed somewhat differently from the common tuning-key, it having two points, *m*, *m*, in addition to the square pipe, the square pipe taking hold of the square head, *g*, of the tuning-pin, *c*, and the two points, *m*, *m*, taking into two of the holes, *j*, *j*, drilled on the collar, *d*, and thus will the tuning-pin, *c*, and the collar, *d*, be turned in one direction, and yet, at the same time, the screw will not make the collar, *d*, more tight on the washer, the object of the screw being only to get the collars sufficiently to bind in the first instance, and afterwards the collar, *d*, acts as a fixed collar.

Figs. 8 and 10, represent a circular piece of metal having a square hole, *n*, formed therein, and also a round hole, *o*; this circular plate is for the purpose of fixing the collar, *d*, to the tuning pin, *c*, and when this plate is used a common tuning-key will be necessary; for when the collar, *d*, is screwed down, and sufficiently tight to produce the necessary friction, the plate, fig. 8, is to be passed over the square head, *g*, of the pin, *c*, and then by means of a screw passed through the hole, *o*, into another

hole formed in the collar, *d*, will prevent the collar, *d*, from being acted on by the screw, *h*, when turned in the act of tuning.

Fig. 9, represents a tuning-pin applicable to a harp, and in this figure part of the top of the wood-work or neck of the harp, is shewn in section; *c*, being the tuning-pin; *i*, the fixed collar; and *d*, the one which screws on to the screw, *h*, but in this instance there are no leather washers, the two collars, *d* and *i*, producing sufficient binding or friction against the two sides of the wood, to retain them in the position into which they have been turned by the tuning-key.

Fig. 10, represents a tuning-pin applicable to a violin, violincello, and other similar instruments, and in a guitar, similar to those for a harp will be used, but smaller and shorter. I would observe, that, by applying black lead or chalk to the surface of the washers and collars an increased effect will be produced.

Having now described the nature and construction of my improvements in piano-fortes and other stringed instruments, I would have it understood, that what I claim is, first, the forming of the rest-plate, *a*, (which carries the tuning-pins in piano-fortes), of cast iron, or of other sufficiently strong metal, whereby great strength will be obtained; and, secondly, I claim the constructing of tuning-pins for piano-fortes and other stringed instruments, having two binding or friction-collars, similar to *d* and *i*, for the purpose of producing sufficient friction to the tuning-pins, *c*, whereby the strings affixed thereto will be kept to their proper tension, and whereby the proper pitch of the note of such strings will be more easily and readily obtained.—In witness whereof, &c.

Enrolled August 2, 1831.

Specification of the Patent granted to George Frederick Muntz, *of Birmingham, in the county of Warwick, Roller of Metals, for an Improved Manufacture of Boilers used for the purpose of generating Steam.*—Sealed October 8, 1833.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said George Frederick Muntz, do hereby declare the nature of my said invention to consist in the application to the manufacture of steam-boilers, of a certain alloy of copper and zinc, the nature of which is set forth and described in the specifications of two certain patents granted to me, the said George Frederick Muntz, the one bearing date at Westminster, the 22nd day of October, 1832, entitled "An improved manufacture of metal plates, for sheathing the bottoms of ships or other such vessels*;" the other also bearing date at Westminster, the 17th day of December, 1832, entitled "An improved manufacture of bolts and other the like ship's fastenings†;" specifications of which said two last-mentioned patents were duly enrolled in his said Majesty's high court of chancery, within the time limited for that purpose, reference being had thereto respectively will more fully appear; and which said specifications contain the following description of the said alloy (that is to say):

"The said alloy is composed of copper and zinc of the following qualities and proportions (that is to say), I take fine copper, called best selected copper, and good zinc, and melt them together in the usual way, in any proportion between fifty parts of copper to fifty parts of zinc and sixty-three parts of copper to thirty-seven parts of zinc, both of which extremes, and all intermediate pro-

* For an Account of this Patent, see Repertory, No. 102, third Series, p. 325.

† For Specification of this Patent, see Repertory, No. 103, third Series, p. 12.

portions, will work at a red heat, but I prefer, in all cases, the alloy to consist of about sixty parts of copper to forty parts of zinc. This compound I cast into ingots of any convenient weight, and then heat them to a red heat and roll them into sheets, or hammer or otherwise work them up into bolts, in the same manner as copper is rolled and worked, only taking care not to over-heat the metal so as to produce fusion, and not to put it through the rollers or hammer or work it after the heat has left it too much, say when the red heat goes off."

Now whereas it is evident that the said alloy may also be made from a compound of copper and calamine, by cementation, taking care that the quantity of calamine shall be such that the zinc extracted from it will be in some of the same proportions to the copper as before mentioned, but as it is very difficult to make the copper take up the necessary quantity of zinc by this process, it is more expensive. It is equally evident, that brass of very good quality, with the addition of zinc requisite to make the proper proportions of copper and zinc will likewise work and roll hot, and answer the purpose, but is again a more expensive mode. I therefore prefer and adopt the process hereinbefore first described for making the said alloy.

Now whereas the said alloy may be made into rivets as well as bolts, or drawn into pipes, both which may be necessary for the purpose of making steam-engine boilers; and I claim as my invention the application of the said alloy to the manufacture of boilers used for the purpose of generating steam for steam-boilers manufactured out of the said alloy, whereby they may be made more light, durable, and cheap, than where copper is used. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland called England, his said dominion of Wales, or Town of Berwick-upon Tweed, I do hereby

declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained. Wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled April 28, 1834.

On the Manufacture of Oil and Spirit Varnishes, Gold Lackers, Gold Size, &c. By J. Wilson Neil, 21, King's Cross, Battle Bridge.

[*Continued from our last, p.* 257.]

On Gums Copal.

Gums copal are of three different sorts and qualities: the best is brought from Sierra Leone, in Africa, and, when imported is about the size of small potatoes, and is covered all over with a rough coat of dust, or clay-like substance. It is most commonly bought in that state by varnish-makers, gum-dealers, and druggists, who scrape it; that is, they generally have women who scrape it, bit by bit, with sharp penknives or razors: it is rather pared than cut quite free from dust; it is afterwards picked by hand into three different qualities. All the finest and palest is put by itself; this call body-gum: pick out the next best, and, placing it by itself, call it carriage-gum. From the remainder pick out all pieces of wood, stones, &c.; this is the third, or worst quality, and serves for gold size or japan black.

The second sort of gum copal, imported from South America, is, in appearance, somewhat like the African, but much larger, and, to those who are not good judges, appears far the best, although in reality not worth one-third the value of African, as, after all the labour of scraping, picking, &c., it is, in general, so full of acid

and sap, that not above two-thirds of it is fusible, and perhaps, in many instances, not more than one-third, and some whole casks are imported not worth one farthing; however, by proper judgment and long experience, there may at times be found some passable samples, which may answer for very cheap varnishes.

The third sort of gum copal is never imported by itself, but is found mixed among the gum anime. It is very large, pale, hard, and transparent, and fuses well and fixes well, and makes excellent varnish.

Gum Anime.

All gum anime is imported from the East Indies, and is sold at the Company's sales in lots of two chests, each weighing from three to five cwt., the sizes varying very much, as well as the quality. The chests which contain the palest and largest gum always sell for the highest price, particularly those chests which are imported ready scraped; as there are great quantities imported which come over unscraped, and is termed pickled, that is, cleaned from its rust by lying for several days in a very strong alkali, well washed with a broom, and afterwards washed with water. This sort is not so good as that which is scraped with the knife, and it in general sells for one-third less than that which is scraped. But in picking and sorting anime, observe and pick out all the fine large and transparent pieces first; these call body-gum: then pick and sort the remainder as directed for the copal, making three sorts. Recollect, all sorts of gums can be procured, ready picked and sorted, from the gum-merchants and dealers.

Amber.

There are two sorts of amber, each of various qualities: the best is imported from Prussia and Poland. It is found in mines and in rivers. It is very thin, solid, pale, hard, and transparent. It is the sort from which

beads are made, and many other curiosities, and forms the most solid, hard, and durable varnish, that can be made, either by employing it by itself, or as a component part with gum, &c. The other sort of amber is called sea-amber: it comes from many places abroad. It is much darker than the first amber, and about the size of coffee-beans; is harder to fuse, has less fluidity, affords most salt, gas, and acid, during its fusion, and leaves a considerable quantity of impure earthy matter at the bottom of the pot on fusion, whereas the best sort will completely dissolve like oil.

Gum Sandarach

Is so well known, that no description is necessary. Procure the largest and cleanest, which will always be found the cheapest in the end.

Gum Mastic

Is likewise well known, can be procured at almost every druggist's shop, and when very fine, mastic-varnish is required for valuable paintings, the mastic is put out upon a tea-tray or mahogany table, and every fine and clean piece picked out, until all the inferior, small, yellow, and dirty, are left. Take a sufficient quantity of the fine picked mastic, and reserve it for making picture-varnish; the inferior reserve for common mastic-varnish.

Gum Cat's-eye

Is a large, pale, transparent gum, but little known; it is quite resinous and pulverulent between the teeth; is like gum sandarach. It is very pale, will dissolve in hot turpentine, is very little better than pale rosin, and is chiefly used in making a varnish for paper-hangings, and adulterates common cheap mastic-varnish.

These are the principal gums required in the making of varnish; any others required being in such very small quantities, their description is unnecessary.

After having procured the necessary gums, and sorted

them as before directed, procure a board about the size of a large tea-tray, and fix on to it a back and two ends, leaving it open at front; procure also a piece of lead, eight inches long by six inches broad, and two inches thick; place the lead on the wooden tray, fill one end of the tray with the assorted gum which requires breaking; procure likewise a small hammer with the end reversing, the proper face of the hammer steeled and ground quite sharp; sit down, and with the left hand drag to one side every piece of gum that does not require to be broke, but every piece above the size of a filbert lay on the piece of lead, and, holding the gum flat and steady between the fore-finger and thumb of the left hand, with the hammer in the right hand, hit the piece of gum one steady stroke, and cut it by piece after piece, into the size of common filberts; the gum is then ready for the gum-pot. Recollect, during the process of breaking gum, to cut out every black, dirty, or watery piece as it comes to hand, and lay them aside, to be used with similar sorts.

On the Choice of Linseed-Oil.

The choice of linseed oil is of peculiar consequence to the varnish-maker, as upon its quality, to a great extent, depends the beauty and durability of the varnish. Oil expressed from green unripe seed always abounds with watery, pulpy, acidulous particles. The quality of oil may be determined in the following manner: fill a phial with oil, and hold it up to the light; if bad, it will appear opaque, turbid, and thick; its taste is acid and bitter upon the tongue, and it smells rancid and strong: this ought to be rejected. Oil from fine full-grown ripe seed, when viewed in a phial, will appear limpid, pale, and brilliant; it is mellow and sweet to the taste, has very little smell, is specifically lighter than impure oil, and, when clarified, dries quickly and firmly, and does not materially change the colour of the varnish when made, but appears limpid and brilliant.

On Essential Oil, or Spirits of Turpentine.

That which is used for mixing varnish ought to be procured and chosen as pure, strong, and free from acid as possible. Some turpentine being drawn from green trees abounds with a pyroligneous acid, which rises and comes over with the spirit in distillation; it is strong and bitter to the taste, and appears milky, particularly towards the bottom, after standing to settle. Therefore, the longer turpentine is kept before it is used, the purer and freer it will be from acid at the top of the cistern, as all its impurities will fall to the bottom, and will be found unfit for any purpose in making varnish.

On the Choice of Driers used in Varnishes.

The driers hitherto used in the making of varnishes have been used either without care or judgment in the most injurious manner, it being the common practice to introduce great quantities of red lead, common litharge, sugar of lead, and foreign white copperas, raw Turkey amber, &c., without either considering the proper quality or quantity, which have had the most injurious effects on the delicate colours upon which varnishes so made (or rather so spoiled) have been applied.

Sugar of lead, when bought for the purpose of adding to varnish as a drier, ought to be that which has been made from white lead, and not that which has been made from litharge, that from white lead being the finest, and in its particles purer and transparent. All sugar of lead contains about 14·2 per cent. of the water of crystallization, so that to use it in that state is very injurious to the varnish, as its water prevents that complete union of the particles of gum, oil, and lead, which ought to combine instantly and form a whole; therefore it is necessary to bruise the sugar of lead into powder, and lay it upon cartridge-paper over a warm drying stove, and keep turning it and moving it about, to prevent its running into a

mass, until it gradually dries; it will then feel quite fine and soft, resembling hair-powder: afterwards sift it through a forty-mesh sieve; it is then fit for driers. Keep it closed up in a dry stone jar until used, otherwise it will absorb moisture from the air.

White Copperas, or Sulphate of Zinc.—The foreign article of this name is chiefly imported from Germany, is that which is generally used as a drier for varnishes, and in its undried state is more objectionable than the sugar of lead, because it both discolours the varnish and injures the oil, by affecting both its elasticity and durability. Another objection to its use in this state, is, that it requires the varnish to be kept for many months to settle; and if the varnish is not made very thin, it will never get clear of the zinc near the bottom of the cistern. It is, therefore, necessary to bruise and dry it exactly as before directed for the sugar of lead. Sift and keep it from the air until the time it is wanted for use. This is the strongest and most effective drier when carefully dried and sifted, because it is then entirely freed from its watery particles. From its astringent quality, it immediately seizes on any aqueous particles, whether from the oil, gum, or turpentine, if a sufficient quantity is used. Such is its astringent and absorbent quality, that if even water were mixed with the varnish, the copperas would seize upon and carry it down to the bottom; neither will it ever combine with the oil, as calces of lead do.

Litharge is to be chosen as free from extraneous earthy matter as possible: that which is from the richest and softest lead is the best, and is termed "Wind-blown," or "W B;" it is in large broad flakes or scales, appears very bright, skins, and feels soft between the finger and thumb when rubbed; whereas the bad quality is distinguishable by an opaque, dull, or earthy appearance, and feels hard and gritty to the touch, and is very full of extraneous matters: this ought always to be rejected, as also all ground litharge; for it is easy to conceive the

injury a mixture of impure lead, iron, and impure earthy matters, would occasion if introduced into varnish.

Red Lead, like letharge, ought to be chosen as free from earthy and extraneous matter as possible. A great quantity of red lead is adulterated with earths, ochres, &c., therefore procure that which is most pure: it is known from its strong, clear, bright colour, by its weight, or, if worth while, it may be easily analysed. The best red lead is a strong and efficient drier when it can be used with safety.

Turkey Amber has been, and is still, used by many as a drier. I, like many others, used it for years, but, from experience, I found it contained nothing of a particular drying quality, being only a mixture of clay, iron, vitriol, zinc, &c. I found it prevented every thing from settling into which it was introduced for a length of time, and I therefore discontinued it. Its best quality is that of an absorbent.

Asphaltum.

There are so many various qualities and descriptions of asphaltum, that it is very difficult to distinguish the good from the bad. There is asphaltum from China, Egypt, France, Neufchatel, and Naples; and many sorts now made in England.

The best which I have found is a native mineral, or genuine Egyptian; it is black, glossy, and heavy, and, when rubbed upon a hot poker, readily melts. It emits a very strong, disagreeable smell, like that of garlic or assafœtida. It will neither dissolve in oil, water, nor turpentine. It is in general, when imported, covered with a coat of dust or clay, and mixed with stones, gravel, &c. This Egyptian asphaltum must be fused, of which read hereafter.

Next in goodness is the Naples, which resembles the other in its external qualities. It is much freer from dirt, will dissolve in oil, but it never yields that intense black

to the same quantity of oil as the real Egyptian. There are several varieties of Naples, French, and German, which will all dissolve in oil, and have very little difference in quality, only I have always found the softest and most fluid the best; yet of late there is asphaltum made in England, and particularly in London, which comes very near in quality to the best French, Naples, or German. It is the residuum left from the burning of rosin, pitch, or linseed-oil, which the makers of lamp-black burn for the purpose of condensing. Linseed-oil burnt by itself produces scarcely any residuum, but when joined with resin, it leaves a very fine asphaltum, not inferior to the best Egyptian; but the asphaltum from pitch is very inferior, as it is coarse, gravelly, and never hardens properly. It has a brown hue or tint. As for the asphaltum made from gas tar, it is unfit either for black japan or Brunswick black, and fit only for inferior purposes.

Having described the apparatus, and most of the necessary ingredients, with their relative qualities, it is now proper to give directions how the various varnishes are made, with their component parts, and the various uses they are intended for, beginning upon a scale which every operator or maker can act upon, as may best suit his own inclinations or circumstances; premising that the before-mentioned general instructions and precautions are always to be strictly borne in mind.

How to make Copal Varnishes for fine Paintings, &c.

Fuse 8 lbs. of the very cleanest pale African gum copal, and, when completely run fluid, pour in two gallons of hot oil, old measure; let it boil until it will string very strong; and in about fifteen minutes, or while it is yet very hot, pour in three gallons of turpentine, old measure, and got from the top of a cistern. Perhaps, during the mix-

ing, a considerable quantity of the turpentine will escape, but the varnish will be so much the brighter, transparent, and fluid; and will work freer, dry quickly, and be very solid and durable when dry. After the varnish has been strained, if it is found too thick, before it is quite cold, heat as much turpentine and mix with it as will bring it to a proper consistence.

Artists' Virgin Copal.

From a select parcel of scraped African gum copal, before it is broke, pick out the very fine transparent pieces, which appear round and pale like drops of crystal; break these very small; dry them in the sun, or by a very gentle fire. Afterwards, when cool, bruise or pound them into a coarse powder; then procure some broken bottles or flint glass, and boil the same in soft water and soda, then bruise it into coarse powder like the gum; boil it a second time, and strain the water from it, washing it with three or four waters, that it may be perfectly clean and free from grease or any impurity; dry it before the fire, or upon a plate; set in an oven. When it is thoroughly dry, mix 2 lbs. of it with 3 lbs. of the powdered copal; after mixing them well, put them into the gum-pot and fuse the gum; keep stirring all the time; the glass will prevent the gum from adhering together, so that a very moderate fire will cause the gum to fuse. When it appears sufficiently run, have ready three quarts of clarified oil, very hot, to pour in. Afterwards let it boil until it strings freely between the fingers; begin and mix it rather hotter than if it were body-varnish, for, as there is but a small quantity, it will be sooner cold; pour in five quarts of old turpentine, strain it immediately, and pour it into an open jar or large glass bottle; expose it to the air and light, but keep it both from the sun and wet, and from moisture, until it is of a sufficient age for use. This is the finest copal varnish for fine paintings or pictures.

Cabinet Varnish.

Fuse 7 lbs. of very fine African gum copal, and pour in half a gallon of pale clarified oil; in three or four minutes after, if it feel stringy, take it out of doors, or into another building where there is no fire, and mix with it three gallons of turpentine; afterwards strain it, and put it aside for use. This, if properly boiled, will dry in ten minutes; but if too strongly boiled, will not mix at all with the turpentine; and *sometimes*, when boiled with the turpentine, will mix, and yet refuse to amalgamate with any other varnish less boiled than itself; therefore it requires a nicety which is only to be learned from practice. This varnish is chiefly intended for the use of japanners, cabinet-painters, coach-painters, &c.

Best Body Copal Varnish for Coachmakers, &c.

This is intended for the body parts of coaches and other similar vehicles intended for polishing.

Fuse 8 lbs. of fine African gum copal; add two gallons of clarified oil (old measure); boil it very slowly for four or five hours, until quite stringy; mix off with three gallons and a half of turpentine; strain off, and pour it into a cistern.

Observe, these varnishes, by being made in the gum-pot, and entirely without driers, are on that account much paler than when each run is poured into the boiling-pot, and afterwards boiled off. Varnish made entirely from African copal possesses more fluidity, pliability, and softness, than varnishes made with, or entirely from, gum anime; it also possesses a property of keeping its colour, or rather becoming bleached or paler after it is applied; whereas, varnishes made from gum anime always become darker after being applied. Genuine copal varnishes, from their pliability and softness, are rather slow in drying, and retain for months so much softness that they will not polish well until they give out a moisture and become hard; then they wear well, will never crack, always and

retain their polish. As they are too slow in drying, coach-makers, painters, and varnish-makers, to remedy that defect, have introduced to two pots of the preceding varnish one made as follows:

8 lbs. of fine pale gum anime, 2 gallons of clarified oil, 3½ gallons of turpentine.	to be boiled four hours.

This, after being strained, is put hot into the two former pots, and well mixed together; its effect is to cause the whole to dry quicker and firmer, and enable it to take the polish much sooner.

Some varnish-makers, contrary to their own judgment, introduce into each small pot of varnish from half to one pound of either sugar of lead or white copperas, and sometimes only half of each; but no varnish made with driers will be so brilliant, colourless, pliable, or wear so long, as that made without it. Every description of varnish which has lead for driers will always be the harder for them, and when worn for a time, if minutely looked into, it will be found that the air has separated the particles of lead, which will be found upon the polished surface of the varnish like an almost imperceptible white dust, exactly in proportion to the quantity of lead introduced into the varnish in making it.

Common Body Varnish for the same purposes as the first.

8 lbs. of the best African copal, 3 gallons of clarified oil, 3½ gallons of turpentine,	boiled four hours, or until stringy,

mixed and strained, will produce about five gallons and a half.

8 lbs. of the best gum anime, 2 gallons of clarified oil, 3½ gallons of turpentine,	boiled as usual,

mixed, and strained hot, and put into the former pot of African gum-varnish. Put two pots of this anime-varnish

to one of copal; it will dry quicker and harderthan the best body copal, and will polish very soon, but not wear either so well or so long.

Quick-drying Body Copal Varnish, for Coaches, &c.

8 lbs. of the best African copal, 2 gallons of clarified oil, ¼ lb. of dried sugar of lead, 3½ gallons of turpentine,	boiled till stringy, and mixed and strained,
8 lbs. of fine gum anime, 2 gallons of clarified oil, ¼ lb. of white copperas, 3½ gallons of turpentine,	boiled as before,

to be mixed, and strained while hot, into the other pot. These two pots mixed together will dry in six hours in winter, and in four in summer; it is very useful for varnishing old work on dark colours, &c.

Best Pale Carriage Varnish.

8 lbs. 2d sorted African copal, 2½ gallons of clarified oil,	boiled till very stringy.
¼ lb. of dried copperas, ¼ lb. of litharge, 5½ gallons of turpentine,	strained, &c.
8 lbs. of 2d sorted gum anime, 2½ gallons of clarified oil, ¼ lb. of dried sugar of lead, ¼ lb. of litharge, 5½ gallons of turpentine,	mix this to the first while hot.

This varnish will dry hard, if well boiled, in four hours in summer, and in six in winter. As its name denotes, this is intended for the varnishing of the wheels, springs, and carriage parts of coaches, chaises, &c.; also, it is that description of varnish which is generally sold to and used by house-painters, decorators, &c., as, from its drying quality and strong gloss, it suits their general purposes well.

Second Carriage Varnish.

8 lbs. of 2d sorted gum anime, 2¾ gallons of fine clarified oil, 5¼ gallons of turpentine, ¼ lb. of litharge, ¼ lb. of dried sugar of lead, ¼ lb. of dried copperas,	boiled and mixed as before.

When three runs are poured into the boiling-pot, and the regular proportion of driers put in, and well boiled, this varnish will dry hard and firm in four hours in winter, and in two in summer: it is principally intended for varnishing dark carriage-work or black japan, and is also used by house-painters for dark work.

Wainscoat Varnish.

8 lbs. of 2d sorted gum anime, 3 gallons of clarified oil, ¼ lb. of litharge, ¼ lb. of dried copperas, ¼ lb. of dried sugar of lead, 5½ gallons of turpentine,	to be all well boiled until it strings very strong, and then mixed and strained.

N.B. Where large quantities are required, it will always be found best to boil off the three runs in the boiling-pot. This varnish is principally intended for house-painters, grainers, builders, and japanners: it will dry in two hours in summer, and in four in winter.

Mahogany varnish is either made with the same proportions, with a little darker gum; otherwise it is wainscoat varnish, with a small portion of gold size.

Japanners' Gold Size.

It is most proper to make gold size in iron pots, as, from the great heat and the quantity of driers required, copper pots are too thin and ductile; they would soon become quite burned at the bottom. Therefore, to make forty gallons of gold size, put ten gallons of oil into the set iron pot, Fig. 1, make a good fire under it, and boil it for two hours; then introduce seven pounds of dry red

lead, seven pounds of litharge, and three pounds of copperas, by sprinkling in a little at a time; let the oil keep boiling all the time, not in too great a heat, or it will perhaps run over. During the time of putting in the driers, keep stirring them from the bottom of the pot; for should they settle in a mass, before the oil has gradually taken them up, it will darken the gold size; therefore, keep constantly stirring, and have the large iron ladle ready to cool it down, if it should appear to rise too high; have also at hand an empty pot—the copper boiling-pot will do—into which immediately ladle part of the boiling oil, if it cannot otherwise be kept in the pot, while the assistant is either choking or damping the fire with wet sifted ashes, of which there always ought to be a wheelbarrowful at hand, in case of an accident; but of which there need not be any fear, if due precaution is observed. It is better to be a little under the heat than above it, particularly by those who are not experienced makers; it will only require a little longer boiling, to make up for the deficiency of heat. When the oil has boiled about three hours from the beginning, and the driers are all in, fuse in the gum-pot ten pounds of gum anime; and during the time of fusing, heat two gallons of raw linseed-oil in the copper-pouring jack, by placing it on the plate of the gum-furnace. After the oil has been poured to the gum, and as soon as, on examination, it appears boiled clear, take the gum-pot from the fire; let it cool for a few minutes, then pour it into the oil in the set-pot. Wash out the gum-pot, and proceed with another run in the same way.

When both runs of gum are in the set-pot, there are altogether fourteen gallons of oil, twenty pounds of gum, and seventeen pounds of driers; increase and keep up a regular fire in the front of the furnace, that it may be drawn out in a moment, if it should be necessary. The gold size will soon throw up a frothy head on the surface, which must be kept down by constantly plying with the

ladle when it is likely to rise within four inches of the pot-edge. In about five hours from the beginning of the oil boiling, it will become stringy; but the boiling must continue until it hangs to the ladle, appears quite stringy, yet drops in lumps. When tried upon the glass, if it feels sticky and strings strongly, then it is boiled enough. Draw out the fire, sprinkle it with plenty of water; leave not a spark of fire in the varnish-house — not even a lighted pipe of tobacco. While the maker is cooling down the pot, let the assistant have ready at the door thirty gallons of turpentine, fill the pouring-pot ready, and have all the doors open. Endeavour to cool it as fast as possible, as it will require at the least one hour and a quarter after the fire has been put out before it will be ready to mix, because the pot being iron, and very thick, and set in bricks, causes the gold size to hold heat a long time, therefore it is difficult to describe exactly at what time to mix the turpentine; for, observe, that if the oil and gum is not sufficiently boiled, the gold size will perhaps not dry quick enough; and if it should, on the other hand, be too strongly boiled before it is cold enough to mix, even though the fire be out, it may become what is termed coagulated or slimy, and is so much concentrated that its particles will not open with the turpentine, and the whole becomes completely lost; so that it is better to err on the safe side, and stop the boiling in time. When the mixing commences, continue the pouring without intermission, until all the froth at the surface disappears, never stirring it until the turpentine is all in. If pouring in the turpentine has commenced while it was too hot, there will be a great loss of turpentine by evaporation; but that will not injure the quality of the gold size.

Place the carrying-tin close to the side of the pot, lay on the tin ladle, and strain off as quickly as possible. When all the gold size is out, pour into the set-pot about three gallons of turpentine-washings, and with the swish wash down the pot as quick as possible; and if the pot is

still so hot as to evaporate the turpentine, ladle it out into the washings again, and pour in about three gallons of raw linseed-oil; and with a palette-knife scrape it all round, washing and cleaning it down with a rag until it is quite cleansed all round; then ladle out the oil, and wipe it completely clean and dry. The gold size ought to dry in from fifteen to twenty-five minutes, and in fourteen days it is ready for use. Experienced makers can make gold size that will dry in five minutes, but that requires great practice.

Black Japan (the best)

Is made after the manner of the gold size. Put six gallons of raw linseed-oil into the set-pot; boil it with a very slow fire. Have a ten-gallon cast-iron pot, with two handles or ears; this pot will fit into the plate of the boiling furnace, fig. 2; into which put ten pounds of Egyptian asphaltum, and make a good fire in the furnace: it will require a good regular fire all the time of fusion. There ought to be an iron cover exactly to fit the fusing-pot; and also a pair of pot-hooks for lifting it from the fire; for sometimes, if the pot is thin and the fire too brisk, it requires lifting from the fire a few minutes to moderate the heat. During the time the asphaltum is fusing, have two gallons of oil getting hot to mix it with as soon as it is sufficiently melted. After it is oiled, leave it on the fire about ten minutes; then either lift it by the pot-hooks, and pour it into the set-pot, or otherwise empty it with a ladle; whichever way it is emptied, leave the stones, &c. at the bottom. Carry it out of doors, and with a handful of hay or straw clear it out, and afterwards wash it out with turpentine washings, and dry it with a rag. Proceed and finish three more separate runs like the first, until there are four runs in the set-pot, that is, forty pounds of asphaltum and fourteen gallons of raw linseed-oil; then introduce exactly the same driers as for the gold size, and in the same manner. Keep a regular,

but moderate fire, so that the boiling continues at a moderate heat for four hours from the last run being poured in the set-pot; then draw and put out the fire for that day. Next morning, as soon as it can be brought to a boil, try it upon a bit of glass; if it but strings strongly, it will not do: it must be boiled so strong, that when a piece is pinched from off the glass, after it has been left to cool, it will roll in a hard pill between the finger and thumb. When it forms hard, and scarcely sticks to the fingers, it is then boiled enough. Put out the fire, as directed before. Leave it one hour and a half before mixing. When cold enough, mix it with thirty gallons, at least, of turpentine, and strain it. If it is too thick when cold, heat and introduce as much turpentine as will bring it to a proper consistency. The japan will dry in six hours in summer, and eight in winter. It is principally intended for and used by coach-makers, japanners, painters, &c., and should be kept at least six months before it is used.

Another Black Japan

Is made by putting into the set-pot forty-eight pounds of Naples, or any other of the foreign asphaltums (except the Egyptian); as soon as it is melted, pour in ten gallons of raw linseed-oil. Keep a moderate fire, and fuse eight pounds of dark gum anime in the gum-pot; mix it with two gallons of hot oil, and pour it into the set-pot. Afterwards fuse ten pounds of dark, or sea-amber, in the ten-gallon iron pot; keep stirring it while fusing; and whenever it appears to be over-heated, and rising too high in the pot, lift it from the fire for a few minutes. When it appears completely fused, pour in two gallons of hot oil, and pour it into the set-pot; continue the boiling for three hours longer, and during that time introduce the same quantity of driers as before directed; draw out the fire, and let it remain until morning; then boil it until it rolls hard as before directed: leave it to cool, and

afterwards mix with turpentine. This japan will appear in colour like the other; but when applied on work, it will dry more hard, compact, and glossy, and will not rub down or polish so soon as the other, which is occasioned by the toughness and durability of the amber.

[*To be concluded in our next.*]

PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

MEANS BY WHICH SIR JOHN F. W. HERSCHEL HAS RENDERED LARGE REFLECTING TELESCOPES APPLICABLE TO THE NICER PURPOSES OF EXACT THEORETICAL ASTRONOMY.—Although the science of astronomy itself does not fall within the plan of the *Repertory*, yet the construction of astronomical instruments, we conceive, belongs strictly to the department of practical knowledge which it is our purpose to improve and to extend. In accordance with this view of the object of our Journal we now lay before our readers an account of the process by which, in the accomplished hands of Sir John F. W. Herschel (whose inheritance of his illustrious father's talents embraces alike the ingenuity required for the construction of astronomical instruments, and the accuracy, skill, and profound acquaintance with the subject necessary for their successful employment in the solution of the higher problems of astronomy), the only obstacle which remained to the application of large reflecting telescopes to the nicer purposes of exact theoretical astronomy, has at last ceased to exist.

In the second part of the *Philosophical Transactions* for the past year is an elaborate paper by Sir John Herschel, consisting of observations of nebulæ and clusters of stars, made at Slough, with a twenty-feet reflector, between the years 1825 and 1833. An appendix explains the manner in which the reduction of the observations, of which the paper itself is a collection, has been executed by the author. It is in the course of this explanation that the final improvement of the reflecting telescope is described. A difficulty presented itself in the reduction of the observed polar distances to mean polar distances at a fixed epoch, arising from considerable fluctuations in the value of a certain expression which was a function of the times of the transit of the objects observed over the vertical wires of the eye-

piece of the telescope. These fluctuations in value, to which the function alluded to was found to be liable in very variable degrees at different epochs of the observations, were occasioned by instability of the instrument, which was partly due to hygrometrical changes, but by far the worst and most intractable part of the fluctuations appeared "to have taken its rise from the shifting of the line of collimation, owing to the mirror taking a new bearing in its cell." "I regret" continues Sir J. Herschel (*Phil. Trans.*, 1833, p. 488), "that I did not earlier perceive this cause of error. It has only recently occurred to me, and the remedy almost at the same instant suggested itself in a simple, and what I trust will hereafter prove an effectual application, of the collimating principle of Rittenhouse and Kater. It consists in attaching to the *inside* of the wooden tube of the reflector a small achromatic telescope, having its object-glass turned towards the speculum, and its eye-end projecting at right angles to the axis of the tube through an aperture in the side, the cone of rays being deflected outwards at a right angle by a small mirror 45° inclined to its axis. In the focus of the object-glass (thus rectangularly deflected), is fixed a cross of fine spider-lines, strongly illuminated by a lamp (capable of being shut off when not wanted), which also serves to illuminate the field. The cross is so situated that its image, seen in the telescope as an object infinitely distant, (according to the principle of the collimator,) makes with all its arms, angles of 45° with the horizontal and vertical wires of the sweeping eye-piece. In the beginning of a sweep, the intersections of both crosses are brought to exact coincidence (by a method presently to be explained); and it is evident that if in the progress of the sweep the slightest shifting of the mirror in its cell should produce a motion of the line of collimation, it cannot fail to be detected by the apparent recess of the two crosses from their original common intersection. A relative motion, to the amount of two seconds of space, either laterally or vertically, cannot possibly escape detection, as I have convinced myself by many trials; and so satisfactory has this mode of overcoming the difficulty in question proved, that I have no hesitation in saying that the only obstacle to the use of large reflectors for the nicer purpose of exact theoretical astronomy (viz. the error caused by the shifting of the mirrors in their cells, by reason of their great weight, and the danger of securing them by strong pressure) has ceased to exist. It is not, however, sufficient to have the means of readily detecting error, without possessing that of correcting it with equal readiness, or at least measuring its amount. A very simple and effectual contrivance accomplishes this. The two adjusting screws by which the mirror-case is supported against the bottom of the tube are terminated, outside of the latter, by large disks or wheels of wood about six inches in diameter, grooved at their

edges. Round these, re-entering cords are conducted over pulleys, to a convenient point within reach at the mouth of the tube, forming a kind of reins, which hang loose when not in use, but by tightening or drawing one or other of them, any motion, however large or minute, may be given to the line of collimation at pleasure. By the aid of this mechanism, the perfect adjustment of the line of collimation (to the full extent of the optical powers of the instrument) is performed in an instant, and may, if we please, be repeated at every observation, being attended with no trouble. Nay, the line of collimation may be purposely deranged to any extent, and immediately corrected. So that by graduating the grooved disks, and adopting an index to each, a very complete distance and position micrometer for the measurement of double stars might be formed, in which, if necessary, two lucid points might imitate the two stars to be compared."

To the foregoing account of his application of the collimating principle, Sir J. Herschel annexes the following note:—

"My first collimator consisted of a small object-glass, by Fraunhofer, of about one inch and a half in diameter, and twelve inches focus. When applied to the twenty-feet reflector, as described in the text, it formed an admirable microscope with its full aperture,—an extraordinary proof of the perfection of its construction, this being doubtless the severest test to which an achromatic object-glass can be possibly subjected. The most beautiful object I can remember to have seen in telescopes was Jupiter entering, perfectly defined, and with all the appearance of a real globe, into the image of a small glass globule, placed in the focus of the collimating telescope. It seemed like the mutual penetration of two solids, or rather two essences of different natures, the one bright and ethereal, the other dark and adamantine. This most exquisite specimen of workmanship was destroyed by an accident. That with which I have been forced, temporarily, to replace it, bears no comparison with the original."

Dr. Stark's Researches on the influence of Colour on the absorption and exhalation of odorous principles.— In the abstract of Dr. Stark's paper already given, (*Repertory* for January, p. 29-30,) his researches on the influence of colour on the absorption of odorous principles were briefly noticed: the subject being quite new and of extreme importance, we now give these researches at large, as printed in the *Philosophical Transactions* for 1833, Part ii.; having inserted in our last number, p. 257—260, his results on the influence of colour on the absorption and radiation of heat.

If the influence of colour over heat attracted but little the attention of philosophers employed in the investigation of the absorbing

and radiating powers of different substances, even when presented to their notice in anomalous facts, which could not easily be explained on any other principle, it is not to be wondered at, that the apparently far less appreciable influence of colour on odours should have totally escaped notice. In point of fact, I am not aware that the subject has hitherto been investigated, and know of no recorded facts in which the influence of colour over odours has been pointed out. In attempting to shew from experiment that the colour of bodies in imbibing odours is correlative with the power of colour over the absorption and radiation of heat, I state a fact which, though new to science, is in admirable correspondence with the known properties of light and heat. And though I may not be able, from the nature of the substances subjected to experiment, absolutely to determine the amount of this connexion, I trust my imperfect investigations may form the basis of new and better devised experiments, by directing the attention of men of science to this hitherto untrodden field of inquiry.

My attention was first directed to the subject of odours, as connected with colour, during my attendance at the anatomical rooms in the winter session 1830-1831. During the earlier part of that winter I generally wore a light olive-coloured dress; but happening one day to attend the rooms in black clothes, I was not a little struck by the almost intolerable smell they had acquired. The smell was so very strong as to be remarked even by the family at home, and it was recognised on the same piece of dress for several days. No odour to the same extent had been remarked in the lighter-coloured clothes. The fetid smell which they more or less acquired in the atmosphere of the rooms was comparatively trifling, and slight exposure to the air alone was necessary to deprive them of the odour which they had thus contracted.

This circumstance led me to begin a series of experiments, to ascertain, if possible, why different clothes of nearly the same texture, but not of the same colour, should attract odours in proportions so very different. The result was, as I had ventured to conjecture, that the colour of bodies independent of the nature of the substance, modifies in a striking manner the capability of surfaces for imbibing and giving out odours.

1. I inclosed black and white wool, ten grains of each, in a vessel with a small piece of camphor, and kept it carefully secluded from the light. When examined six hours afterwards, it was at once evident to the sense of smell that the black wool had attracted more of the odorous particles than the white wool, though neither had gained any appreciable weight.

2. I took equal weights of black and white wool and put them in a small drawer along with a piece of assafœtida; in twenty-four hours

the black wool had contracted a strong odour of the gum, while in the white wool, the smell was scarcely perceptible.

3. To try the effect of odours upon a vegetable substance, I took equal quantities of black and white cotton wool, and inclosed them with assafœtida. Two similar quantities were at the same time exposed to the emanations of camphor in another drawer. In both the black-coloured cotton had attracted the greatest quantity of odorous particles, as palpably evidenced by the smell.

These experiments were made in the month of April, 1831; but it was not till August following that I had an opportunity of extending the investigation to other colours.

4. I inclosed equal weights of black, red, and white wool, in a drawer with assafœtida; and similar quantities of these coloured wools in another drawer with camphor. The result was as before. The black in both experiments had attracted by far the greatest quantity of odorous particles, as evidenced to smell; the red next followed in point of intensity of smell, and the white, so far as could be judged, had attracted least of the odour.

5. The same experiments were tried on cotton of similar colours, and with the same results.

Circumstances prevented me from resuming these investigations till the summer of 1832, when I repeated the experiments with a greater variety of coloured substances, in wool, cotton, and silk, and satisfied not only myself but many of my friends, that odour was attracted nearly in the same ratio as caloric, by coloured substances. The experiments were conducted in the same manner as the preceding.

6. I inclosed six different coloured wools, an equal weight of each, viz. black, blue, green, red, yellow, and white, with assafœtida. They were ranged circularly round the odorous body, without touching it or one another, and were then covered over and excluded from the light. At the end of twenty-four hours they were examined. The black was found to have much the strongest smell of assafœtida; the blue the next; after that the red, and then the green, the yellow had but little smell, and the white scarcely any.

7. A similar experiment, using camphor instead of assafœtida, afforded precisely the same results.

8. Various coloured cottons were treated in the same manner. In all these the smell was invariably found to be of corresponding intensity, according to the colour, as in the wools.

9. Silks of different colours gave the same results.

10. I next endeavoured to ascertain the comparative power of vegetable and animal substances, so far as regards their influence over odours. This was a much more delicate point to ascertain with

sufficient accuracy, and free from fallacy, as it was difficult to obtain wool of the same degree of fineness as cotton, the substances I generally preferred for these experiments. I first inclosed equal weights of black and white wool, and black and white cotton, with camphor. After twenty-four hours, the black wool had acquired a stronger smell than the cotton of similar colour; the white wool had also taken up more of the odorous particles than the white cotton, though the odour in both was very feeble.

11. When assafœtida was used in a similar experiment, the odour was much more distinguishable, and it could at once be distinguished by smell, that the wool had taken up much more of the odour than the cotton. Indeed, from many experiments I have made to ascertain this fact, wool appears to have a peculiar attraction for fetid odours. For instance, if, after having allowed wool to lie in contact with camphor for some time, it be afterwards placed, even for a very few hours, near a minute portion of sulphuret of barium (which, it is well known exhales copiously the fetid odour of sulphuretted hydrogen), it quickly looses the camphorous smell, and acquires and even retains in considerable intensity, the fetid smell of the sulphuret. It is proper to mention, that in most of these experiments I did not trust to my own olfactory organs alone. All the members of the family, and several of my friends, have lent their aid to distinguish between the different intensities of the odour which each substance had attracted; and though only a few experiments are here detailed, similar ones have been many times performed, with various other odorous substances. The whole of these in their general results seemed to establish the fact, that the colour of substances exerted a peculiar influence over the absorption of odours.

In all these experiments, however, reliance had to be placed upon one sense alone, viz. that of smell, as none of the substances employed had gained any appreciable weight. I was therefore, desirous, that, if possible, at least one experiment should be devised, which would shew, by the evidence of actual increase of weight, that one colour invariably attracted more of any odorous substance than another; and upon considering the various odorous substances which could be easily volatilized without change, and whose odour was inseparable from the substance, I fixed upon camphor as the one best suited to my purpose. In an experiment of this nature it was necessary that the camphor should be volatilized, or converted into vapour, and that the coloured substances should be so placed as to come in contact with the camphor while in that state. It was therefore of the first importance to prevent currents of air within the vessel in which the experiment was conducted, and with this view I used a funnel-shaped vessel of tin plate open at the top and bottom. This rested on

a plate of sheet iron, in the centre of which the camphor to be volatilized was placed. The coloured substances, after being accurately weighed, were supported on a bent wire, and introduced through the upper aperture. This was then covered over with a plate of glass. Heat was now applied gently to volatilize the camphor; and when the heat was withdrawn and the apparatus cool, the coloured substances were again accurately weighed, and the difference in weight noted down.

Proceeding on this plan, I arrived at the most satisfactory and conclusive results. The deposition of the camphor in various proportions on the coloured substances submitted to experiment, offered evidence of the particular attraction of colours for odours, resting on ocular demonstration; and when to this is added the evidence arising from a positive increase of weight, as ascertained by the balance, the conclusions previously drawn from the sense of smell are confirmed in a singular and very satisfactory manner. I have in this mode repeated all the former experiments with differently coloured substances; but shall here only detail a few, as sufficient to shew the general results.

1. I took ten grains, of white, and the same quantity of black, wool, and having suspended them in the manner stated, vaporized the camphor. When the apparatus cooled, I found, on weighing the wool, that the white had gained 1 $\frac{5}{10}$ grain in weight, and the black 1 $\frac{8}{10}$ grain.

2. In a similar experiment, but using three colours of wool, white, red, and black, I found the white wool had gained $\frac{3}{10}$ths of a grain; the red $\frac{8}{10}$ths; and the black $1\frac{4}{10}$ths grain.

3. In another, where the heat was applied for about ten seconds, the white had gained no appreciable weight, and but little smell; the red had gained $\frac{1}{10}$ of a grain; while the black had acquired $\frac{2}{10}$ths of a grain.

4. In an experiment with black, red, green, and white wool, the results were—

Black gained	$\frac{3}{10}$ grain
Red	$\frac{2}{10}$
Green	$\frac{2.5}{10}$
White	$\frac{1}{10}$

5. In an experiment with wools of nearly the same fineness, coloured black, blue, red, green, and white, ten grains of each, exposed to the vapour of camphor, the result stood thus:—

Black gained	$1\frac{2}{10}$ grain
Dark blue	$1\frac{2}{10}$

Scarlet red	1 grain
Dark green..................	1
White	$\frac{7}{10}$

In repeating this experiment the dark green was $\frac{7}{10}$, while the red was only $\frac{6}{10}$, the others in the order as before.

I now varied the experiment by employing square pieces of card of equal size, coloured with different preparations of lead. This was done with the view of ascertaining whether smooth surfaces of equal density, and coloured nearly as possible with matter of the same nature, would absorb odorous particles with the same facility as loose portions of wool. The colours were mixed up with a solution of gum arabic, and laid on the cards as equally as possible with a camel-hair pencil.

6. Pieces of card of equal size being coloured as mentioned, with various preparations of lead, namely, red, brown, yellow, and white, and previously weighed, were exposed to the vapour of camphor in the vessel before described. After exposure for some time, and when cool, it appeared on weighing that the

Red had gained	1 grain
Brown.	$\frac{9}{10}$
Yellow	$\frac{5}{10}$
White......................	a trace

The whole of the upper surfaces of the red and brown cards were thickly covered with a fine light downy deposit of camphor. The white card had an extremely fine deposit on its surface, but inappreciable by the balance, which turns with the fiftieth part of a grain.

7. Another experiment with cards, coloured black, red, brown, yellow, and white, exposed to the vapour of camphor, gave the following results:—

Black gained	1 grain
Red	$\frac{9}{10}$
Brown	$\frac{7}{10}$
Yellow	$\frac{5}{10}$
White	$\frac{4}{10}$

8. In a similar experiment with cards coloured black, dark blue, dark brown, orange red, and white, the attractive powers were as follows:—

Black gained..................	$\frac{9}{10}$ grain
Dark blue....................	$\frac{8}{10}$
Dark brown	$\frac{4}{10}$
Orange red	$\frac{3}{10}$
White.......................	$\frac{1}{10}$

In all these experiments it was invariably found that the black attracted most, the blue next; then followed the red and green; and after these the yellow and white. The heat was never continued so long as to warm the apparatus, else the whole camphor would have been driven off. Neither was such a quantity of camphor used as would have given a thick coating to the wool employed, as then the attraction of the coloured surfaces might have been diminished.

1. The next set of experiments were intended to ascertain the comparative attraction of animal and vegetable substances. The first of these was upon equal weights of black wool and black silk, (ten grains,) exposed to the vapour of camphor in the manner already stated. The black wool gained $1\frac{5}{10}$ grain, and the black silk $1\frac{7}{10}$ grain. From this experiment it would appear that of these two animal substances, silk possesses the greatest attraction for odours.

2. In equal weights of white wool and white cotton, the cotton had gained $\frac{3}{10}$ths of a grain, and the wool $\frac{4}{10}$ths.

3. In another experiment with white silk, white wool, and white cotton, ten grains of each, the result was:—

Silk had gained	$3\frac{5}{10}$ grains
Wool	$2\frac{4}{10}$
Cotton....................	$2\frac{2}{10}$

4. In a similar experiment with the usual weight of the same articles,

Silk had gained	$1\frac{4}{10}$ grain.
Wool	$\frac{5}{10}$
Cotton....................	$\frac{4}{10}$

5. Another experiment, in which black silk, black wool, and black cotton, were exposed, in equal quantities of the usual weight, to the vapour of camphor, as before described, gave this result:—

Black silk had gained	$\frac{2}{10}$ grain
Black wool..................	$\frac{1}{10}$
Black cotton	$\frac{1}{20}$

6. An experiment with white silk, white wool, white cotton, and white card, each weighing ten grains, and exposed as before, gave the following results:—

White silk had gained........	$1\frac{9}{10}$ grain
White wool	$1\frac{1}{10}$
White cotton	1
White card	$\frac{4}{10}$

The last experiments tend to shew that different substances attract odours in different proportions, and this independent of the texture or fineness of the substance employed. Wool, though generally coarser in the filament than cotton, has yet a greater attraction for oduors;

and silk more than wool. The general conclusion would appear to be, that animal substances have a greater attraction for odours than vegetable matters; and that all these have their power much increased by their greater darkness or intensity of colour. These experiments seem also to establish, that the absorption of odours by coloured substances is regulated by the same law which governs the absorption of light and heat. The analogy goes still further; for in other experiments made with a view to ascertain this point, I invariably found, that the power of colour in radiating or giving out odours, was in strict relation to the radiation of heat in similar circumstances. My first experiments on this branch were with differently coloured wools, inclosed for a certain time in a drawer along with assafœtida and camphor, and afterwards exposed for a specific period to the action of the air. Though one can easily judge by the sense of smell alone the different intensities which these articles have acquired immediately on being taken out of the drawer, yet, after exposure for some time to the air, the difference of intensity is much more difficult to be perceived. In general it seemed to me that the whole of the substances lost their sensible odour in nearly the same space of time, though the odorous particles given out by the black were of course much greater in quantity than in the others.

To demonstrate this, I took pieces of card, coloured as before, black, dark blue, brown, orange red, and white, and after having exposed them to the vapour of camphor, in the usual manner, they were taken out of the vessel, weighed, and left in the apartment for twenty-four hours. Upon carefully re-weighing the cards at the end of this period, it was found that the black had lost one grain; the blue nearly as much; the brown $\frac{9}{10}$ths of a grain; the red $\frac{8}{10}$ths; and the white $\frac{5}{10}$ths of a grain. In about six hours after this the black and blue had completely lost their camphor; the brown and red had the merest trace, inappreciable to a delicate balance, while the white still retained about $\frac{1}{10}$th of a grain.

In another experiment with cards, coloured dark blue, dark brown, orange red, yellow, and white, they had gained in weight, after exposure to the vapour of camphor,

Dark blue	$\frac{9}{10}$ grain
Dark brown	$\frac{8}{10}$
Orange red	$\frac{6}{10}$
Yellow	$\frac{5}{10}$
White	$\frac{4}{10}$

After lying in the apartment for twenty-four hours, the cards were again carefully weighed when the camphor remaining was found to be on the

Dark blue	$\frac{1}{30}$ grain
Dark brown	$\frac{1}{10}$
Orange red..................	$\frac{2}{10}$
Yellow	$\frac{1}{10}$
White..	$\frac{3}{10}$

Hence in the same space of time the loss in each was,

Dark blue	$\frac{26}{30}$ grain
Dark brown	$\frac{21}{30}$
Orange red..................	$\frac{12}{30}$
Yellow	$\frac{12}{30}$
White......................	$\frac{2}{30}$

The influence of coloured surfaces upon the absorption and emission of odours, having, I trust, been satisfactorily shewn, it only remains for me to state shortly some of the practical conclusions which may be drawn from the experiments detailed.

If it be thus certain that odorous emanations have not only a particular affinity for different substances, but that the colour of those substances materially affects their absorbing or radiating quality, the knowledge of these facts may afford useful hints for the preservation of the general health during the prevalence of contagious or epidemic diseases. From their minute division and vast range of action, latent poisonous exhalations or effluvia, inappreciable by the balance, may, no doubt, exist to dangerous extent without being evident to the sense of smell. But in most cases it will be found, that, when contagious diseases prevail to such extent, the emanations from the sick will, if attended to, give the surest indications of the contamination of the surrounding air.

Experience has sufficiently proved, that emanations, once generated in, or communicated to, the human body, may be conveyed from one individual to another, and even through the medium of clothing or merchandize from one place to another. This has been particularly observed in plague; and hence, in countries where this disease is liable to occur or be imported, the institution of quarantine establishments, to prevent personal intercourse, or the dispersion of goods, till a certain number of days have elapsed, during which the disease, if existing, should appear;—articles of merchandize and clothing being at the same time purified by exposure to the air, or fumigated. Though this transport of disease has been more particularly observed in plague, yet instances of the same nature have occurred in other diseases, more particularly small pox, and more recently, it has by many been supposed, cholera.

It is unnecessary to detail here the means of purifying infected

goods, or fumigating the apartments of those who have been known or suspected to labour under diseases supposed to be communicated by contagious effluvia. It is sufficient to state, that exposure to a high temperature, fumigations with chlorine and sulphur, and free exposure to the air, are found amply sufficient for the first; and apartments are now generally recommended to be purified with chlorine, and washed with caustic lime. As to fumigation with chlorine, it cannot be denied that this will destroy the animal effluvia floating in the air exposed to its action. But unless this fumigation be frequently repeated, it can have but little effect, as the walls and furniture will be constantly contaminating the air by giving out the deleterious particles which they had previously absorbed. Lime-washing has generally been supposed to act in the same manner as fumigations, viz., by destroying the contagious emanations, but from the experiments of Guyton Morveau, it would seem that caustic lime, and indeed lime in any state, has no such effect. It merely absorbs the gases which disguise the odour, but neither changes its deleterious properties nor alters its real smell. He therefore disregards lime-washing, except as a general mode of cleaning walls, and attributes no other beneficial effect to it than as contributing to cleanliness.

The results of my investigations have led me to form a very different opinion. It is to white-washing that I should attribute much of the good effects that have been observed to follow the purifying means generally employed. In such cases I should trust more to white-washing the walls, personal cleanliness, and free ventilation, for destroying or diminishing the effects of supposed pestilential or hurtful effluvia, than to any other measures. Acid and other fumigations, except chlorine, only disguise, but do not destroy the property of animal effluvia to produce disease.

In the late epidemic cholera here, it is well known that this disease first broke out in the village of Water-of-Leith, situated a little to the north-west of Edinburgh, and lying on both sides of the stream of the same name. Many of the inhabitants were seized with the disease and fell victims to its severity. If a damp and low situation, with accumulated filth of all kinds, render disease more fatal, this was certainly a place likely to suffer severely, and at first it did so. But the Board of Health, with the promptitude for which they were distinguished, quickly got the filth, so far as practicable, removed, the houses fumigated, and the walls white-washed outside and inside. By these means the disease seemed at once to be arrested; its virulence was much abated, and it gradually declined. The fumigations in this case could only act upon the deleterious emanations in the air at the time, but unless constantly renewed could not affect the fresh emana-

tions generated from those labouring under the disease. The necessary ventilation must also have speedily carried off the chlorine. The white-washing, on the other hand, although it had no specific action on the contagious effluvium, yet, by constantly presenting a reflecting surface, prevented the absorption of the emanations by the walls, and thus tended, with moderate ventilation, to keep the air of the apartments pure. Dirty dark-coloured walls, on the contrary, would readily, as has been demonstrated, absorb noxious odours, and as soon as the effect of the fumigation was over, gradually give them out again.

The good effects of white-washing appeared strikingly in another instance at this particular time; for I venture to assert, that, if human means had any influence over this disease, Edinburgh owes much of the mildness of its attack to the white-washing of its steep and narrow lanes and closes, the walls of the common stairs, and most of the hovels inhabited by the lowest classes of the community, and not to the partial fumigations and sprinkling with chloride of lime, which the first breath of wind carried off. The whiteness of the walls prevented them from absorbing the deleterious emanations, and the currents of air were thus enabled to sweep them away, before they had accumulated to such a degree as to become an active source of disease.

Next, therefore, to keeping the walls of hospitals, prisons, or apartments occupied by a number of individuals, of a white colour, I should suggest that the bedsteads, tables, and seats, should be painted white, and that the dress of the nurses and hospital attendants should be of a light colour. A regulation of this kind would possess the double advantage of enabling cleanliness to be enforced, at the same time that it presented the least absorbent surface to the emanations of disease.

On the same principle it would appear that physicians and others, by dressing in black, have unluckily chosen the colour of all others most absorbent of odorous exhalations, and of course the most dangerous to themselves and patients. Facts have been mentioned which make it next to certain, that contagious disease may be communicated to a third person through the medium of one who has been exposed to contagion but himself not affected (See treatise on the Epidemic Puerperal Fever of Aberdeen, by Alexander Gordon, M. D. London, 1795); and indeed the circumstance of infectious effluvia being capable of being carried by medical men from one patient to another, I should conceive one of the means by which such diseases are often propagated, in the ill-ventilated and dirty habitations of the poor exposed to their influence.

Even in my own very limited experience I think I have observed some melancholy instances of the effect of black dress in absorbing the

hurtful emanations of fever patients in a public hospital; and many facts are incidentally related by medical writers and referred to other causes, which I should not hesitate to ascribe chiefly to exposure of this nature. Not to mention individual cases, in the sessions held at Oxford, in July 1577, "there arose amidst the people such a damp that almost all were smothered" (Stow's Chronicle). Lord Bacon attributes this effect to the "smell of the gaol, where the prisoners have been close and nastily kept," and mentions it having occurred twice or thrice in his time, when both the judges that sat upon the trial, and numbers of those who attended the business, or were present, sickened or died" (Pringle's Observations on Diseases of the Army, p. 296). A similar occurrence, related by Sir John Pringle, happened at the Old Bailey sessions in 1750, when four of the judges were attacked and died, together with two or three of the counsel, one of the under-sheriffs, several of the jury, and others present, to the amount of about forty in the whole (Ibid. p. 297). My explanation of the peculiar fatality of these emanations to the judges, counsel, and jurors, was the attraction of their official black for the putrid effluvium, as Sir John calls it; and the escape of two of the judges who sat on one side of the Lord Mayor, to the current of air in the room not sending the baneful odours in their direction.—*Phil. Trans.* 1833, Part ii. p. 300—312.

On the Employment of Filters in Chemical Analysis. By Dr. Turner, Professor of Chemistry in the University of London.—In my own researches I am in the habit of determining the weight of substances collected on a filter in one of three different ways. One of these, introduced by Berzelius, consists in burning the filter in a platinum crucible, and deducting the weight of its ashes. This method is peculiarly applicable to the analysis of minerals, where such substances as silica, alumina, and lime are frequent. Even some substances of easy reduction, such as peroxide of iron and sulphate of baryta, may be safely treated in the same way; but in these cases it is advisable not only, as usual, to separate the mass of the precipitate from the filter before setting it on fire, but to moisten both with a little nitric acid, and to ensure very free exposure to the air during the burning of the paper and the subsequent ignition. For such purposes I commonly use some excellent Swedish filtering paper, kindly procured for me by Berzelius.

Another method is that of the double filter, introduced by Dr. Thomson, which I have used in all the experiments where filtration is spoken of in the present and former communication. Both Berzelius and Dr. Thomson himself seem inclined to doubt the accuracy of this method; and it is certainly liable to objection, except with certain precautions and with very compact filtering paper. The paper which I use for the double filter is considerably thicker than the

Swedish paper, and of such compact texture, that recently precipitated oxalate of lime, or sulphate of baryta, thrown down by Glauber's salt in a neutral solution of the chloride of barium, may be filtered by it. The precautions employed are these. The paper, folded into filters, is macerated in dilute nitric acid for two days, is then fully washed with warm distilled water, and dried at a temperature of 212° Fahr. After acquiring its hygrometric moisture, two of the filters of nearly the same weight are poised against each other, and any small difference marked in pencil on the lighter one. Before being used, a pin-hole is made in the outer filter, in order that any accidental imperfection in the inner filter should be made apparent. After filtration both filters are dried at the same temperature, and are afterwards allowed to recover their hygrometric moisture completely before removal to the balance. In repeated trials I have found a pair of filters to recover, after use, their original relation in weight to within the 100th part of a grain; nor have I ever noticed a greater deviation than may well be expected in every process where filtration is concerned. Additional testimony of the same kind will be found in my Essay printed in the Philosophical Transactions for 1819 [1829], where, in two sets of experiments, the same point is investigated by the use of double filters, and by evaporating the precipitate to dryness without filtration.

A third method consists in employing a single filter, which is dried before and after filtration at some fixed temperature, as at 212° Fahr.; and when so dried is inclosed in a light silver vessel, the cover of which is tightly fitted by grinding. The filter may thus be deliberately weighed without absorbing moisture during the operation. In case of its being inconvenient to employ an uniform temperature, the filter may be dried at a variable heat, be allowed to absorb hygrometric moisture, and afterwards kept at about 60° Fahr. for two hours in a closed bottle, the bottom of which is covered with pulverized quick-time. In this method, while operating at least with paper of British manufacture, it is essential, more so than with the double filter, to have previously macerated the filter in dilute acid; for all such paper, which I have examined, contains lime.—*Phil. Trans.* 1833, Part ii. p. 542.

New Analyses of Corrosive Sublimate and Calomel. By Dr. Turner.—*Bichloride of Mercury.*—The corrosive sublimate of commerce was purified by repeated crystallization from distilled water, and was then well dried at its subliming temperature. It might in that state be sublimed without giving any trace of humidity. Of this chloride 137·595 grains were dissolved in warm water, and directly decomposed by nitrate of silver; and the chloride of silver was washed with water acidulated with nitric acid, and amounted in the fused state

to 144·374 grains, equivalent to 35·659 of chlorine. The bichloride of mercury would hence seem to be composed of

Mercury	101·936..	.201
Chlorine	35·659...	70·31

giving 35·16 as the equivalent of chlorine. This result led me to suspect some imperfection in the method of analysis; and I accordingly found that some of the bichloride of mercury is apt to combine with the chloride of silver, and being expelled when the latter is fused, a loss of chlorine is occasioned. To avoid this error, the bichloride was decomposed by lime, which was prepared from Carrara marble, and was quite free from muriatic acid. The requisite quantity of lime, previously slaked, was mixed with a little warm water, and the solution of a known weight of corrosive sublimate gradually added, shaking the mixture after each addition. After a short digestion and filtration, the liquid was neutralized by nitric acid, and the chlorine determined by nitrate of silver in the usual manner. Every trace of muriatic acid may thus, without the necessity of boiling the materials together, be transferred to the lime and rendered soluble, while the oxide of mercury, of an orange colour, is left with the excess of lime. In this way I obtained the three following ratios:—

	1.		2.		3.	
Mercury	113·441..	201	113·149..	201	112·535..	201
Chlorine	39·748..	70·428....	39·723..	70·565....	39·433..	70·43

According to these results we obtain 35·214, 35·28, 35·26 as the equivalent of chlorine.

Calomel.—The proto-chloride, though much more stable than the protoxide of mercury, is very subject to change. I believe it is impossible to sublime calomel without a portion being resolved into mercury and corrosive sublimate; and after washing calomel, so as to remove the adhering bichloride, the heat subsequently required for rendering it quite dry causes a fresh production of corrosive sublimate. I selected for analysis the pulverulent white calomel prepared by Mr. Howard, and dried it by exposure to a continued heat of 300° Fahr., at which temperature it undergoes no appreciable decomposition, and contains only a trace of moisture. But that trace of humidity affects the ensuing results with a small error, the tendency of which is to make the equivalent of chlorine smaller than it is. The following are the ratios of three careful analyses, which were made by means of lime, as in the analysis of corrosive sublimate.

	1.		2.		3.	
Mercury..	100·048..	201	95·154..	201	76·565..	201
Chlorine..	17·602..	35·361 ...	16·721..	35·32....	13·473..	35·37.

Phil. Trans. 1833, Part ii. p. 533.

Phænomena of the action of Iodine upon Starch connected with the use of those substances as chemical tests; observed by M. M. Leroy, Chevallier, and Lassaigne.—The following observations relative to the mutual action upon each other of iodine and starch, are important relatively to the use of those substances as tests reciprocally of each other's presence, by the blue colour of their combination, the one in the chemical examination of mineral waters, the other in that of vegetable infusions: they are extracted from the *Lond. and Edinb. Phil. Mag.* for March and April, as derived from several foreign Journals.

M. Leroy of Brussels, has found that water is requisite to the production of the blue colour which arises from the action of iodine on starch: in alcohol the iodine becomes merely of a dark brown colour, and water causes the blue colour to appear. M. Chevallier has also remarked that farinaceous substances mixed with starch, which are always moist, when subjected to the vapour of iodine, acquired a brown [blue ?] colour, while potato starch became of a golden yellow merely. He concluded, from this circumstance, that iodide of starch is of a yellow colour, and that this by absorbing [and combining with] water became blue hydrate; and he found that when this yellow compound was touched with a moistened tube, it became instantly blue.*

M. Lassaigne remarks, that in making some experiments on the combination of iodine with amidine [starch altered by heat] which is easily obtained by gradually pouring an alcoholic solution of iodine into the solution obtained from the starch extracted cold from bruised grain, he found its fine deep indigo blue colour gradually disappear by the action of heat, and at a temperature of about 175° to 195° of Fahr. it entirely disappeared, the fluid remaining transparent. It was at first supposed that the iodide of amidine had been decomposed by the heat; but this was not the case, for, on cooling, the blue colour gradually reappeared, and eventually became as dark as at first. This experiment of the alternate destruction and reproduction of colour may be several times repeated, provided the heat be not continued longer than is required to decolourize the liquor; and a few minutes boiling beyond this point destroys the power of reproduction. In this, however, it did not appear that the iodine was volatilized by the vapour of water, as might be supposed; for it is found, in part, in the decolourized liquor in the state of hydriodic acid, mixed with a portion of undecomposed amidine; and the addition of a few drops of a weak solution of chlorine explains why the blue colour is reproduced by this chemical agent.

* Facts corresponding with those described by M. M. Leroy and Chevallier have been observed by the contributor of these notices of the Progress of Science, in preparing and employing various solutions of iodine and starch as tests.

OBSERVATIONS AND EXPERIMENTS ON KELP. BY DR. TRAILL.—The following observations and experiments on kelp, were communicated by the author in a letter to Professor Jameson, who delivered it to Lord Greenock, for the purpose of being laid before the directors of the Highland Society of Scotland. In a letter to the Depute-Secretary of that Society, his Lordship makes the following remarks:

"The object of this paper being to suggest certain improvements in the process of manufacturing kelp, which is a branch of industry of very great importance to a large portion of the inhabitants of our coast and islands, renders it worthy of attention on its own account, independently of the circumstance of its having proceeded from the pen of an individual so distinguished for his abilities and scientific attainments as Professor Traill, who is himself the proprietor of a small estate in a kelp district, and has had experience in this manufacture. This, combined with his knowledge of chemistry, has given him the advantage of being able to investigate the matter practically as well as theoretically. There are several other points in this paper of considerable interest, as connected with the subject to which Dr. Traill more particularly refers, namely, The value that, through this means, may be given to fern, a plant that has hitherto been considered an unprofitable weed, so much so, that it was this year under the consideration of the Directors to offer a premium for the best plan of extirpating it; and the advantage of using peat as the fuel for the combustion of the fuci, in the process, particularly after it has undergone compression, and of the employment of peat-ashes, both for the purpose of extracting the potash from it, and for the manure, for both which purposes they are much in demand on the continent, and have even been exported from thence to England."

Experiments and observations on kelp.—The experiments and observations on kelp, which I mentioned to you, were suggested by the distress, and in some cases the inevitable ruin, which the sudden loss of that branch of national industry has occasioned in the northern parts of Scotland. My experiments were made at different times, and not under the most favourable circumstances; but they are sufficient to convince me that most important improvements may be easily introduced into the manufacture of kelp, by which its quantity of [comparatively] *free alkali*, or carbonate of soda, may be much increased, and the article again restored to a marketable value. I may premise, that, in early life, I was familiar with the process of kelp-making; and about thirty years ago made some experiments on fuci [sea-weed], from which I concluded that they do not contain *free* alkali, but that soda and potash exist in them only as muriates [chlorides] and sulphates; or perhaps, rather, that their vegetable fibre yields the salts of potash, and that the salts of soda are derived from the sea.

About two or three years ago, the recollection of these early observations induced me again to examine this subject, and I propose to give you an abstract of the views on the manufacture of kelp, suggested by my experiments.

A. It will be readily admitted, that kelp, as ordinarily manufactured, is a most rude product, containing much unconsumed vegetable matter, which is of no use in the arts.

The free [carbonated] alkali in kelp, I consider as wholly derived from the incineration of the plants imbued with salt water; and I found that the quantity of this free alkali was increased by a more perfect combustion. I found, also, that if I burnt kelp again, along with a fuel which yielded potash, a larger quantity of *free* alkali (subcarbonate [carbonate] of soda) was obtained, than from ordinary kelp. This I attribute to a further decomposition of the muriate of soda [chloride of sodium], or common salt; partly by the high temperature, in contact with a combustible, but chiefly by the greater affinity of potash than soda for muriatic acid [of the base of potash than of that of soda for the chlorine which is the radical of muriatic acid].

B. After various experiments, I found a cheap and abundant fuel in *peat*, well suited to both objects. It greatly aids the more perfect combustion of the fuci, and some kinds of it yield no inconsiderable portion of potash on combustion. The dense and black coloured peat is not the best for this purpose. That which contains most vegetable fibres or stems is the best, or what is usually removed from the surface, and is but little prized as a fuel for ordinary purposes.*

The rationale of the process appears to be as follows: Kelp contains of saline matter, chiefly the following,—muriate of soda [chloride of sodium], muriate of potass [chloride of potassium], subcarbonate of soda, and sulphurets of [the bases of] both,—with some combination of ammonia, which is decomposed when lime is heated with kelp, and may be collected as liquid ammonia [solution of ammonia] in small experiments. These alkaline salts appear to be formed from muriates and sulphates, by the usual process of combustion; but much of the muriate of soda remains decomposed, until the potash of the peat lends the aid of chemical affinity, to assist the decompounding power of combustion.

C. I have, on this last principle, found that the addition of American

* My attention to peat was excited not only by the abundance of that fuel in kelp-making districts, but by the fact, that large quantities of peatash are sold in Holland, and in the northern parts of Germany, as a most valuable manure; and no inconsiderable importation of it into Britain has taken place of late years, for a similar purpose. It is chiefly to the potash which it contains, that its value as a manure is to be attributed. The stems of the common fern yield still more alkali.

potash, or, where it can be had, our common fern, cut and dried, during the combustion of fuci, or the re-burning of kelp, greatly increases the product of subcarbonate of soda, and probably such addition might be advantageously employed in the first manufacture of kelp.

D. Closed fire-places have a great effect in aiding the combustion and expelling sulphur from the alkaline salts; an ingredient which is the product of the decomposition of the sulphuric acid of the sulphates, naturally existing in fuci. Such is the outline of an improved mode of manufacturing kelp; which, from experiments on the small scale, I believe to be very advantageous, and which, I have reason to think, are now in process of being tried on a large scale.

But there is no necessity for the kelp-maker to rest satisfied with producing even this superior article. He has been driven from the market by the low duty on foreign alkali, and by the soda manufacture from common salt; he may, in places where peat abounds, turn the tables on his rivals, and become a manufacturer of alkali, in a state of greater or less purity.

E. All that is necessary, is to purify the kelp in the same manner as those who extract carbonate of soda from *black ash*, as it is termed. For this purpose, the kelp, prepared as above, should be broken down, and again burnt with peat in a *reverberatory furnace*, to which quick lime is occasionally added. The high temperature, the combustible, and the quicklime, will still farther decompose the muriates, and separate the sulphur from the alkalies.

I believe that peat will give a heat of sufficient intensity; if not, it may be aided by well coked coal, or common coal free of sulphur. The lately devised method of forming peat, in all weathers, by compression, appears well suited to produce an unlimited supply of fuel, which will give out more heat by its condensation, than uncompressed turf.

F. The contents of the *roasting* or *reverberatory* furnace, should be then transferred to large tubs or vats, in which the soluble ingredients should be dissolved in water; and when clear, the supernatant liquid should be drawn off into other cisterns, in which an addition of American potash is to be made. When it is intended thus to purify kelp, the addition of the potash, or the ashes of *ferns*, should be made *after the roasting*, as none of it will be wasted by combining with sulphur.

G. The clarified liquor is now to be concentrated by boiling, until the water is sufficiently evaporated to allow the saline contents to crystallize, which will either be regular, like the common *soda* of commerce, or in a confused saline mass, according to the slowness or quickness of the process.

This, you will perceive, is a mere sketch, but sufficient to awaken

attention to the subject. The successful prosecution of the plan will depend on the judgment with which fit situations for carrying it on are chosen; and, where the kelp-maker wishes also to be a soda manufacturer, on the skill with which his furnaces and evaporating vessels are constructed. In this last case, considerable advantage would be obtained from concentrating the liquid before crystallization, by applying the heat of flues, and perhaps, also, by employing the influence of *air* on divided portions of the fluid or evaporation, as is done in the salt-works on the continent before it is boiled for the last time.

The demand for alkali is so great, that I have no doubt of the valuable results from such a plan; and should these suggestions be found the means of affording employment to many who are now suffering from the loss of their former occupation, or generally useful to my countrymen interested in the manufacture of kelp, the time and trouble dedicated to these reseaches will be esteemed a small price for the satisfaction it will afford to, dear sir, yours, &c.—Edinburgh, 5th July, 1833.—*Prize Essays and Transactions of the Highland Society of Scotland,* vol. x., p. 240—245.

On the use of Kelp combined with Peat-Ashes as a Manure. By A. K. Mackinnon, Esq.—In 1832, a Scotch acre of dry stony ground, a great part of which had formerly been the channel of a rivulet, was prepared in the way usually followed in the cultivation of turnip.

A quantity of sea-weed was collected, dried and burned in the same manner as for kelp; but instead of allowing it to form into a solid mass, it was removed from the fire in a calcined state, in order to save the expense of afterwards grinding it.

Of the ashes thus manufactured, twenty bushels were allowed to the acre, and distributed in the drills with a barrow made on the principle of bone-dust sowing machines.

When the turnips which were sown on this acre sprouted, they had an unhealthy green, or rather yellowish appearance, but after some time, several patches in the field seemed to be growing luxuriantly, while others seemed to retain their sickly hue. Upon a careful investigation into the cause of this phænomenon, it was discovered that wherever the ground was deepest, and the ashes of the sea-weed had been most mixed up with the soil, the turnips were best; and, on the other hand, that where the ashes, not being mixed with the soil, came in contact with the seed, the turnips did not at all thrive. In cleaning the ground preparatory to drilling it, the weeds were collected into heaps and burnt on the spot; and it was observed that, on the site of these heaps, the turnips were very nearly as good as those on an adjoining piece of ground which had been manured solely with dung.

In order to find out if the kelp-ashes would have any effect upon an after-crop, the turnips were not consumed upon the ground. Last spring the land was merely harrowed and sown down with oats and grass-seeds, and the oats, which have been lately reaped, were quite as good as those which grew on that part of the field manured solely with dung, except that they came up much thinner. The young clover is, however, thicker, and altogether looking better than any crop of the same kind I have ever seen in this part of the country.

As the result shewed that the quantity of kelp-ashes used in this experiment was far too great, at least for the first crop, and as the plants which grew on those portions of the field where the ashes of the weeds were scattered, were so far superior to the rest, the experiment was repeated this year with a mixture of kelp and peat-ashes. A field of six acres was sown down with this mixture, distributed in the drills as before, at the rate of six bushels of the kelp-ashes and twenty-four of the peat-ashes to the acre; and although, from various causes, the turnips were not sown till the first week in August, they have grown remarkably well; and now, little more than two months from the date of sowing, the average weight of them is from 2¼ lb. to 2½ lb.

Supposing kelp to be worth 3*l.* 10*s.* per ton, each bushel of the kelp-ashes would cost about two shillings, and the peat-ashes, which were in this instance collected from a number of poor cottagers in the neighbourhood, who had been directed to keep them dry and free of all sort of extraneous matter, cost sixpence per bushel, so that, upon the whole, the price of the manure was twenty-four shillings per acre. The labour of men and horses being exactly the same as in sowing bone-dust, it is unnecessary to offer any calculation of this part of the expense.

If this experiment be found to succeed elsewhere, as it has done here (and there can be little doubt that, after a little more experience, and in abler hands, it will succeed much better), it may one day open up an important source of revenue, if not to kelp proprietors, at least to their poor tenantry, no individual of whom uses any sort of fuel but peat. At first it was somewhat difficult to convince the poor people from whom the peat ashes were obtained for the experiment above detailed, that they would be really purchased from them, and the consequence was, that at least one-half of the quantity which each family with a little attention could have supplied was thrown on their dunghills, where, though it was eventually of some service, they would never think of putting it, if they knew that they could convert it into money. A man, however, was paid twenty-five shillings for his winter's ashes, and this year there is little doubt that he will, besides enjoying the comfort of a better fire than he was accustomed to have, earn at least 2*l.* for what, till now, he had been in the habit of throw-

ing at the threshold of his door, as an invitation to cholera or some other loathsome disease.—Corry, Isle of Skye, October, 1833.—*Prize Essays and Transactions of the Highland Society of Scotland*, vol. x., p. 245—247.

On the probable future Extension of the Coal-Fields at present worked. By the Rev. W. D. Conybeare, M.A., F.R.S., &c.—In the application of geological science to the development of the mineral resources which constitute so material a part of the wealth of nations, no subject can possibly claim a higher statistical importance, than the investigation of the relations of our principal coal districts, with a view to point out the lines in which we may look with the greatest probability for the future profitable extension of their workings, when the immense and increasing demand for that mineral shall threaten to exhaust our present supplies; a period which some apprehensive geologists have predicted to be within a few centuries. Although I myself incline to be more sanguine, still every one must allow the discussion to be one of the very first economical interest. I have already in my former geological publications often alluded to it; but I am persuaded that a short connected view of what is already known may at the present moment be useful, and may very probably tend to elicit fresh information in the points where it will thus be shewn to be most important.

I shall first hastily survey, with this view, the great coal-fields of Durham and Yorkshire, on the eastern skirt of the great chain of the Penine hills, which traverses, as a back-bone, our northern counties. I shall then examine the detached fields scattered through the plains of the midland counties to the south of the expiration of that chain, and thus proceed to those on its western skirt, extending thence to the borders of Wales, and still more to the north, skirting the Cumbrian or Lake Mountain group. Lastly, I shall speak as to the coal-fields of our south-western districts of Somerset, Gloucester, and South Wales.

I. The Northumberland and Durham coal-field is well known, extending from the mouth of the Coquet on the north to the banks of the Tees on the south. The dip of the strata is along the northern edge to the south-east and through the middle of the field due east; but at its southern extremity along the Tees, near Bishop's Auckland, the line of bearing appears to curve, and they change their dip, first to north and then to north-west. Along the south-eastern border they are uniformly overlaid by a terrace of magnesian limestone; but Mr. Sedgwick has satisfactorily shown that they are capable of being profitably pursued beneath this limestone, and actually have been so in many instances. Here, therefore, is an extension of the field apparently limited only by the expense of deep drainage. But the most

important point connected with our inquiry presents itself on the south of the Tees, where, in consequence of the curvature which we have mentioned of the line of bearing of the coal strata to the east and north-east, the magnesian limestone, extending in its regular course to the south, overlies unconformably their edges, and comes in contact with the more unproductive subjacent strata of millstone grit, &c. Now it ought carefully to be ascertained whether this curvature near Bishop's Auckland be more than a merely partial inflection; and whether the main coal strata do not speedily resume their southerly bearing, beneath the covering of the magnesian lime-stone, under such circumstances that they might still be profitably worked.

From the Tees to the Wharfe, the eastern terrace of magnesian limestone in its course through northern Yorkshire, appears almost immediately in contact with the more barren inferior strata; but Mr. Smith, in his Geological Map of Yorkshire, has indicated a thin zone of carboniferous measures as accompanying the greater part of its course; and Mr. Sedgwick has indicated coal as worked in this interval near the banks of the Gore at Winksley, and on the right bank of the Nid near Bilton. Now if in pursuing these indications eastward, in the direction of the dip beneath the magnesian limestone, the main seams were recovered, and traced throughout the interval between the Tees and Wharfe, a district fully equal to those already worked might be laid open; and as the seams of the Somersetshire coal-field are worked under a still thicker covering of superincumbent strata of magnesian limestone, red marl, and lias, I do not doubt that these might be worked with equal ease; and I believe I have often heard Mr. Sedgwick express his opinions to the same effect.

South of the Wharfe the main coal-seams again emerge, and continue exposed throughout the great field of south Yorkshire and Derbyshire, as far as the banks of the Derwent; but here they are again overlaid by the superincumbent strata, for the red marl, sweeping round to the west in this direction, overflows, as it were, all the extensive plains of our midland counties, effectually concealing all the subjacent strata.

I do not believe that any judicious endeavours have been made to trace the probable prolongation of the coal-beds of Nottingham beneath this covering to the south of the Derwent; and this is one of the points which most demands, and would ultimately best repay, such researches. I am thus conducted to the scattered coal-fields of our midland counties, which may probably be regarded as partial indications of the southern extension of the fields already traced; but as these will require a more minute detail, I must reserve them for a future communication.—*Lond. and Edinb. Phil. Mag. March*, 1834.

A. T.

CRITICAL NOTICES AND REVIEWS.

The Practical Irrigator and Drainer. By George Stephens. Edinburgh: Blackwood, 1834.

The value of the process or art of irrigation is comparatively but little understood, that is, in a practical point of view; for although every one must have heard of the fertilizing effect of the overflowing of the Nile and other rivers, still the agency of a systematic plan of an overflow of water in the process of vegetation, has been applied to a very limited extent, when we take into account the immense tracts of land which are advantageously situated for pursuing this valuable application of water: and if the process itself were well understood, we have no doubt the steam-engine might be advantageously applied in situations where an overflow of water could not be obtained from natural sources. We are aware that considerable skill is required in laying out and leveling the land, and more particularly in regulating the quantity of water permitted to flow, the time which the operation is allowed to continue, and also the time requisite for drying the soil after the overflow,—these being most material to a successful application of the principles, and requiring considerable practice and attention. If it were more generally known, that a plant of common spearmint, in the space of seventy-seven days, increased seventeen grains in weight, with no other food than pure rain-water, still more with spring water, and much more with Thames water*, the process of irrigation would be more generally resorted to, and many tracts of land now uncultivated might, for a comparatively small outlay, be brought into a high state of fertilization.

Mr. Stephens, the author of the work now before us, appears to have been largely employed in this branch of cultivation, with very considerable success, under these

* Dr. Woodward's Experiments.

circumstances. A detailed account of the plans he pursued cannot but prove valuable and interesting. The variety of instances given of the cost of performing the work, and completing the process of irrigation, with the crops afterwards produced from the land, hold out the greatest possible encouragement for pursuing this means of cultivation.

The work however is not confined to irrigation, but in addition we have a practical treatise on draining land, with a report of the Royal Agricultural Society at Örebro, on draining land on Elkinton's system. In this latter part of the work we would particularly call attention to the extensive and valuable information on the subject of draining bogs. The work is not one of those which is to be considered with critical nicety, as to the manner in which it conveys information, but should be weighed by the matter it contains, and then it will justly deserve our most favourable recommendation.

The Architectural Director; being an approved Guide to Builders, Draughtsmen, Students, and Workmen, in the Study, Design, and Execution of Architecture. By John Billington, Architect. London: Bennett, 1834.

This is the first of twelve parts which are to appear monthly till complete. If the present prove to be a fair specimen of what is to follow, this work will deserve the attention not only of practical men, but will be found a valuable addition to the library of the general reader. It contains seven plates, with thirty-two pages of letter-press on the historical department of the art, added to which are sixteen pages of a Glossary of Architecture. We have no doubt that the work will meet with general attention; this will, however, equally depend on the future parts. These we shall take an early opportunity of noticing.

The Artificer's Complete Lexicon for Terms and Prices. By John Bennett, Engineer. London: Bennett, 1834.

This is a volume containing a great variety of useful information—price lists of carpenters', joiners', builders', cabinet-makers' and masons' work; prices of almost every article of hardware and engine-work, with tables of weights and measures. We have submitted the work to some of our friends who are better acquainted with these matters than ourselves, and it has met with their approbation, we may therefore recommend it. There is also this point in its favour, that although the price lists cannot last for a very great length of time, when improvements and rates of wages are constantly changing the value of work, there will still remain matters of considerable importance, which will long make the book one of valuable reference.

NOTICE OF EXPIRED PATENTS,

[*Continued from No. 2, p.* 135.]

William Collins, of George Street, Grosvenor Square, Middlesex, Lamp-maker, for some useful additions to, and improvements on, carriage and other lamps.—Sealed March 10, 1820.—(*For copy of specification, see Repertory, Vol.* 41, *second series, p.* 7.)

William Pritchard, of Castle Street, Southwark, Surrey, Hat-manufacturer, and Robert Franks, of Red Cross Street, London, Hat-manufacturer, for an improved method of manufacturing water-proof hats, to be made of silk, wool, or beaver or other fur, the brims of which are perfectly water-proof, and will, in all weathers and in every climate, preserve their original shapes, being stiffened without the use of glue, or any other material which would prevent the effect of water-proof mixture.—Sealed March 18, 1820.—(*For copy of specification, see Repertory, Vol.* 40, *second series, p.* 138.)

Frederic Mighells van Heythuysen, of Sidmouth Street, St. Pancras, Middlesex, Esq., for a method of making portable machines or instruments to be placed upon a desk or table, and so contrived as to fold or not into a small compass, made of wood, brass or other metal, to support a silken shade, made for the purpose of protecting the eyes from a strong light; added to which is a green, blue, or other coloured glass, in a frame, and in such a po-

sition, that when placed opposite a window, lamp, or candle, it will take off the glare of white paper, by sliding a green or blue, or any other tinge, dependant upon the colour of the glass reflector, upon the book or paper placed within the bounds of its shadow, so that print, however small, or writing, is rendered more plain or legible, by reason of the glare being thus taken off the white paper by day, and particularly by candle-light; by this means the eyes of the reader or writer will be relieved from injuriously dwelling upon a white surface. —Sealed March 18, 1820.—(*For copy of specification, see Repertory, Vol.* 39, *second series, p.* 274.)

Abraham Henry Chambers, of Bond Street, Middlesex, Esq., for an improvement in the preparing or manufacturing substances for the formation of the highways and other roads; which substances, when so prepared, are applicable to other useful purposes.—Sealed March 18, 1820.

Francis Lambert, of Coventry Street, St. James's, Westminster, Middlesex, Silversmith and Jeweller, for a new method of mounting and producing, and also removing, preserving, and replacing, the figure in weaving gold-lace, silver-lace, silk-lace, worsted-lace, cotton-lace, thread-lace, and other laces, whether made or composed of the aforesaid articles, any or either of them, or a mixture thereof. Communicated by a foreigner residing abroad.—Sealed April 11, 1820.

Henry Constantine Jennings, of Carburton Street, Fitzroy Square, St. Pancras, Middlesex, Esq., for a lock or fastening for general use.—Sealed April 11, 1820.

William Hall and William Rostill, of Birmingham, Warwickshire, Tortoiseshell-box-makers, and partners in trade, for a certain improvement in the manufacture of hafts, handles, or hilts, for knives, forks, swords, or any other instruments to which hafts, handles, or hilts are necessary, and can be applied, whether made of turtle or tortoiseshell, or other suitable material.—Sealed April 11, 1820.

Thomas Burr, of Shrewsbury, Salop, Plumber; for certain improvements in machinery for manufacturing lead and other metal into pipe and sheets.—Sealed April 11, 1820.—(*For copy of specification, see Repertory, Vol.* 41, *second series, p.* 267.)

Edward Coleman, Professor of the Veterinary College, St. Pancras, Middlesex; for a new and improved form of construction of shoes for horses.—Sealed April 15, 1820. (*For copy of specification, see Repertory, Vol.* 40, *second series, p.* 73.)

Major Rohde, of Leman Street, Goodman's Fields, Middlesex, Sugar Refiner, for a method of separating or extracting the molasses or syrup from Muscovado or other sugar. Communicated by a foreigner residing abroad.—Sealed April 15, 1820.—(*For copy of specification, see Repertory, Vol.* 40, *second series, p.* 78).

William Brunton, of Birmingham, Warwickshire, Engineer, for

certain improvements on, and additions to, fire-grates.—Sealed April 19, 1820.

George Lilley, of Brigg, Lincolnshire, Gentleman, and James Bristow Fraser, of Blackburn House, Linlithgow, Scotland, Gentleman, for certain improvements in the application of machinery for propelling boats or other vessels floating in or upon water, and for attaining other useful purposes, by means of an hydropneumatic apparatus, acted upon by a steam-engine, or other adequate power.—Sealed April 19, 1820.

Thomas Hancock, of Little Pulteney Street, Golden Square, Middlesex, Coach Maker, for the application of a certain material to various articles of dress and other articles, by which the same may be rendered more elastic.—Sealed April 29, 1820.—(*For copy of specification, see Repertory, Vol.* 40, *second series, p.* 14).

Thomas Cook, of Brighton, Sussex, Engineer, for an improved apparatus for the purpose of cooking, which he designates, A Philosophical Cookery.—Sealed April 29, 1820.

LIST OF NEW PATENTS.

Janet Taylor, of East Street, Red Lion Square, in the county of Middlesex, for improvements in instruments for measuring angles and distances applicable to nautical and other purposes.—Sealed March 27, 1834.—(*Six months.*)

Henry William Nunn, of Wippingham, in the Isle of Wight, Bobbin Net Lace Manufacturer, for improvements in manufacturing certain kinds of embroidered lace.—Sealed March 27, 1834.—(*Six months.*)

James Walton, of Sowerby Bridge, in the county of York, Cloth Dresser, for improvements in cards for carding wool, cotton, silk, and other fibrous substances, and for raising the pile of woollen and other cloths.—Sealed March 27, 1834.—(*Six months.*)

John Cooper Douglas, of Great Ormond Street, in the county of Middlesex, Esq., for a method of constructing an apparatus or apparatuses from which a motive principle of power is obtained, likewise for increasing said motive principle, applicable to various denominations of locomotion and to machinery that is stationery, and also for raising solid and fluid bodies, and various other

useful purposes, and also for constructing and forming of apparatus and vehicles to be propelled or worked by means of the said power.—Sealed March 29, 1834.—(*Six months.*)

William Hirst, of Leeds, in the county of York, Clothier, for certain improvements in machinery for the better dressing and finishing woollen and other fabrics.—Sealed March 31, 1834.—(*Six months.*)

Hooton Deverill, of Manchester, in the county of Lancaster, Gentleman, for a method of engraving and etching on cylindrical surfaces for printing and other purposes.—Sealed March 31, 1834.—(*Six months.*)

George Millichap, of Birmingham, Carriage Axle-tree Manufacturer, for certain improvements on locomotive machines or carriages.—Sealed March 31, 1834.—(*Six months.*)

Herman Hendricks, of the Strand, in the county of Middlesex, Gentleman, for improvements in the process of dyeing wool and woollen fabrics yellow. Communicated by a foreigner residing abroad.—Sealed April 8, 1834.—(*Six months.*)

Henry Crosley, of Hooper Square, Leman Street, in the city of London, Engineer, for an improved method or process, arrangement, and combination of apparatus, with certain agents used or employed therewith, whereby evaporation of fluids and solutions may be effected advantageously, and also for other beneficial purposes to which the said method or process is applicable or can be applied. Sealed April 8, 1834.—(*Six months.*)

Auguste Victor Joseph D'Asda, of Adam Street, Adelphi, in the county of Middlesex, Gentleman, for certain improvements on pumps or machinery for raising water or other fluids. Communicated by a foreigner residing abroad.—Sealed April 10, 1834.—(*Six months.*)

Samuel Morand, of Manchester, in the county of Lancaster, Merchant, for improvements on his improved stretching machine, for which he obtained letters patent dated April 14, 1831.—Sealed April 12, 1834.—(*Six months.*)

JOHN BEARE, of Pall Mall East, in the county of Middlesex, Civil Engineer, for certain improvements in engines or machines for raising or conveying water or other fluids.—Sealed April 12, 1834.—(*Six months.*)

WILLIAM WILLIAMS, of Pembrey House, near Llanelly, and THOMAS HAY, of Kidwelly Tin Works, both in the county of Carmarthen, Gentlemen, for improvements in preparing certain metals applicable to the sheathing the bottoms of ships and other purposes.—Sealed April 17, 1834.—(*Six months.*)

JOHN HENRY CASSELL, of Millwall, Poplar, in the county of Middlesex, Merchant, for a cement or combination of materials applicable to the purposes for which cement, stone, brick, or other similar substances may or can be used.—Sealed April 19, 1834.—(*Six months.*)

JOHN HEWITT, of Kenegie, Cornwall, Gentleman, for a combination of certain materials or matters, which being combined or mixed together, will form a valuable substance or compound, and may be used with or as a substitute for soap.—Sealed April 19, 1834.—(*Six months.*)

JUAN JOSE SEGUNDO, of Burton Crescent, in the county of Middlesex, Esq., for an apparatus or method applicable to side saddles for giving the security to persons when riding.—Sealed April 22, 1834.—(*Six months.*)

JOSEPH SHEE, of Lawrence Pountney Place, in the city of London, Gentleman, for certain improvements in distillation.—Sealed April 22, 1834.—(*Six months.*)

JOHN BETHELL, of Mecklenburgh Square, in the parish of St. Pancras and county of Middlesex, Gentleman, for certain improvements in machinery or apparatus for making metal screws, pins, bolts, and rivets.—Sealed April 24, 1834.—(*Six months.*)

ERRATA IN NO. III., FOR MARCH.

P. 176, line 7 from bottom, *for* 3200 *read* 32000.

177, — 3 *for* "$\frac{3}{16}$ tin, smelt]" *read* "$\frac{3}{16}$ tin] melts."

178, — 1 to 10, the quotation should extend to the end of the paragraph; thus: "approximative merely."

THE

REPERTORY

OF

PATENT INVENTIONS.

No. VI. NEW SERIES.—JUNE, 1834.

Specification of the Patent granted to JOSEPH HARDWICK, *of Liverpool, Gentleman, for certain Improvements in Paddle-Wheels.*—Sealed December 17, 1832.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said Joseph Hardwick, do hereby declare the nature of my invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

My invention relates to certain improvements added to an ordinary paddle-wheel, whereby I am enabled to cause the float-boards or paddles to enter and leave the water in the most advantageous position for applying the power (by which such paddle-wheel is caused to revolve) in the most beneficial manner in propelling vessels. But in order that my invention may be fully understood and carried into effect, I will describe the drawing hereunto

annexed, first observing that the same letters of reference indicate similar parts in all the figures.

Description of the Drawing.

Fig. 1, represents a paddle-wheel with six paddles or float-boards, having my improvents attached thereto.

Fig. 2, shews one of the spindles separately, by which the turning of the paddles or float-board is effected, such paddles or float-board turning on axes as will be hereafter fully described.

Fig. 3, represents a toothed wheel, which is securely affixed on one of the bearings which supports the main shaft of the paddle-wheel. *a, a,* are the float-boards or paddles. *b,* is the main shaft of the paddle-wheel which receives its motion, as usual, from the power contained in the vessel. *c, c,* are the spindles described in fig. 2, and which are contained within the arms, or spokes, *d, d,* which are hollow for the purpose of receiving them. These spindles, *c, c,* turn in bearings at each end, one end of each spindle having its bearing in the nave of the wheel, and the other end of each spindle having its bearing at *e,* affixed on one of the rings of the paddle-wheel, as shewn in the drawing. On to one end of the spindles, *c,* is affixed a worm or screw, *f,* which takes into and drives a pinion, *g,* which is affixed on each of the axles of the paddles or float-boards. The axes of the paddles or float-boards, *a,* turning in bearings on each side of the paddle-wheel. *h,* is a pinion affixed to the other end of the spindles, *c,* by which each spindle receives a rotatory motion during the time that the paddle-wheel is caused to revolve, which is effected by the toothed wheel, *i,* fig. 3, affixed to the side of the vessel or to the bearing of the main shaft *b.* The toothed wheel, *i,* being at all times stationary, consequently the teeth on the pinions, *h,* take into the teeth of the wheel, *i,* round which they are caused to turn by the revolution of the paddle-wheel, and thus motion will be given to the spindles, and, consequently

to the paddles or float-boards, as will be evident on inspecting the drawing.

Now whereas I would observe, that various means have at different times been resorted to, for the purpose of causing the float-boards or paddles to take similar positions, I do not therefore claim the placing of the paddles or float-boards of paddle-wheels on axes, as above described, but only the means of giving the desired motion thereto.

And whereas I do declare that my improvements consist in the application of the spindles, *c*, *c*, with their screws and pinions actuated by the revolution of the paddle-wheel, as above described. And such my invention being, to the best of my knowledge and belief, entirely new, and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called England ; his said dominion of Wales, or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same; and that I do verily believe this my said specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained, wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled June 15, 1833.

Specification of the Patent granted to James Lutton, *of Dean Street, Soho, in the county of Middlesex, Chair Maker, for certain Improvements in Easy Chairs.*—Sealed January 31, 1833.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Lutton, do hereby declare the nature of

my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

My invention consists in constructing easy chairs in such manner that the upper part (consisting of the back and arms) acts on curved surfaces, or segments of circles, as will be fully described hereafter, by which means any desired inclination may be obtained to the back of the chair, whilst at the same time the back part of the seat will be elevated and adjusted to suit the inclination to the back of the chair. In order that my invention may be fully described and understood, I will describe the drawing hereunto annexed first observing that the same letters in the various figures refer to the same parts wherever they occur.

Description of the Drawing.

Fig. 1, represents a perspective view of an easy chair, constructed according to my improvements.

Fig. 2, is a side-section of the framing by which the arrangement and construction, at the same time the action of several of the parts, will be more clearly seen.

Fig. 3, is a plan of the framing, shewing the framing of the seat in its place.

Fig. 4, is a plan of the lower framing, the upper part of the chair being removed, as well also as the seat; by this means the arrangement of some of the parts which are placed under the seat will be more clearly seen, and their use more readily understood.

Fig. 5, shews one of the side-framings of the upper part of the chair, consisting of the back and arm, *a*, and the side-rail, *b*: this side rail, it will be seen, is formed of a curve or segment of a circle, as is shewn in this figure. *c*, *c*, are front and back cross-rails, by which the other side-framing is connected, and by this means the

upper part of the chair is constructed. *d*, are grooves cut on the inside of the rail, *b*, into which enter stops, as will be hereafter described.

Fig. 6, represents one of the side-framings, of which the lower part of the chair is formed, and consists of two legs, *e*, *e*, which are connected, as shewn in the drawing, and the upper part of the lower side-framing is shaped to a curve or segment of a circle, to correspond with that formed in the framing, fig. 5, which, as above described, forms the upper side-framing of the chair. *f*, *f*, fig. 6, are two cross-rails, by which the lower side-framings, *e*, *e*, are securely connected, and thus is constructed this lower framing. In the side-section, fig. 2, these parts are shewn in their places, that is, the upper side-framing, supported by the under side-framing, and capable of being moved backwards and forwards on the curved surfaces or segment of circles, and they are retained together by means of the stops or plates, *g*, *g*, which are screwed on to the lower framing: these stops, or plates, enter into the grooves, *d*, *d*, on each side of the chair, formed in the upper framing, as before described, and by means of these stops or plates, *g*, *g*, the back is prevented falling too far back, at the same time is prevented coming too forward; and it will thus be evident, that on the length of the grooves, *d*, *d*, will depend the quantity of inclination, which can be given to the back. *h*, is the leg-rest, which consists of the frame, *i*, for the feet, which is hinged to the part or frame, *h*, as shewn in the various figures, the frame, *h*, being suspended to the two sides of the chair, and move on studs at *j*, *j*. A side-view of the rest, *h*, *i*, is shewn separately at fig. 7, and a front view is shewn separately at fig. 8. *l*, is a lever, or bar, which is shewn in figs. 2, 3, and 4: this lever or bar *l*, is affixed by a hinge to the back cross-rail, *f*, and also by a hinge to the framing, *h*, of the leg-rest, the cross-rail, *f*, being cut out in the middle to receive it at the time the seat is brought to its lowest position; and this is also the case

with the front rail, *c*, to permit of the lever or bar, *l*, rising at the time of the back being reclined to the greatest extent, and it is by means of this leg-rest and the lever or bar, *l*, that the chair is made to accommodate itself to the desire of the individual sitting on it. *m*, is the quadrangular frame for the seat which is attached to the front cross-rail, *c*, by means of the pins, *n*, *n*, which allow of a slight movement, that is, permit the back of the seat to be slightly elevated as the back of the chair is caused to recline. On to the under sides of the side-rails, *m*, *m*, of the seat, are formed two inclined planes, *o*, *o*, one on each side, and on to the back cross-rail, *f*, of the lower part of the chair are placed two friction-rollers, *p*, *p*, over which the inclined planes, *o*, *o*, move, which cause the back part of the seat to rise as the back of the chair reclines. The framing of an easy chair being thus constructed is next to be stuffed as is represented in fig. 1, or in any way desired.

Having now described the manner of constructing easy chairs according to my improvements, I will describe the manner of its action. An individual (sitting in the chair), when it be desired to incline the back of the chair, presses against the back, at the same time placing the hollow of the feet on the bar, *i*, of the leg-rest, thus cause that bar to move outwards from the chair; by this means the upper framing, *a*, of the chair will move on the lower framing, and the back of the chair will be inclined as is shewn by dotted lines in fig. 2, and the leg-rest will project in front of the chair, as is also shewn by dotted lines in that figure. The seat, *m*, is connected to the front cross-rail, *c*, consequently the act of reclining the back of the chair causes the seat, *m*, to be moved towards the back, and the inclined planes, *o*, *o*, rise over the friction-rollers, *p*, *p*, and thus slightly raise the seat, *m*, When the back is reclined, and the individual is desirous to lessen the inclination, or cause the back of the chair to stand in its first position, then by merely pressing the

bar, *i*, of the leg-rest downwards to the ground by the feet, and slightly inclining the body, the back of the chair will follow to the position required.

Having now described the nature of my invention, and the manner of producing and using the same, I would have it understood that various contrivances have been before used for causing the backs of easy chairs to recline, I do not therefore claim this as any novel feature, neither do I claim any of the parts separately of which the same is composed, nor do I confine myself to the precise shape or style of getting up the chairs shewn in the drawing, as the same may be varied to suit the taste of individuals; but what I claim as my invention is the forming the upper and lower framings of easy chairs in two parts, and in such manner that they act by means of curved surface or surfaces formed of the segments of circles, aided by a bar or lever, *l*, and a leg-rest, as above-described. —In witness whereof, &c.

Enrolled March 30, 1833.

Specification of the Patent granted to James Neville, *of Great Dover Road, in the county of Surrey, Engineer, for an Improved Apparatus for Clarifying Water and other Fluids*—Sealed September 9, 1831.

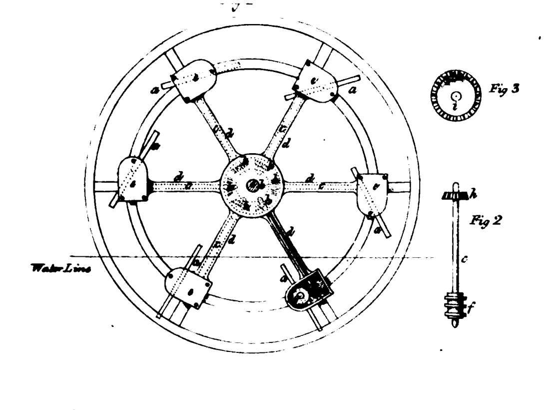
WITH AN ENGRAVING.

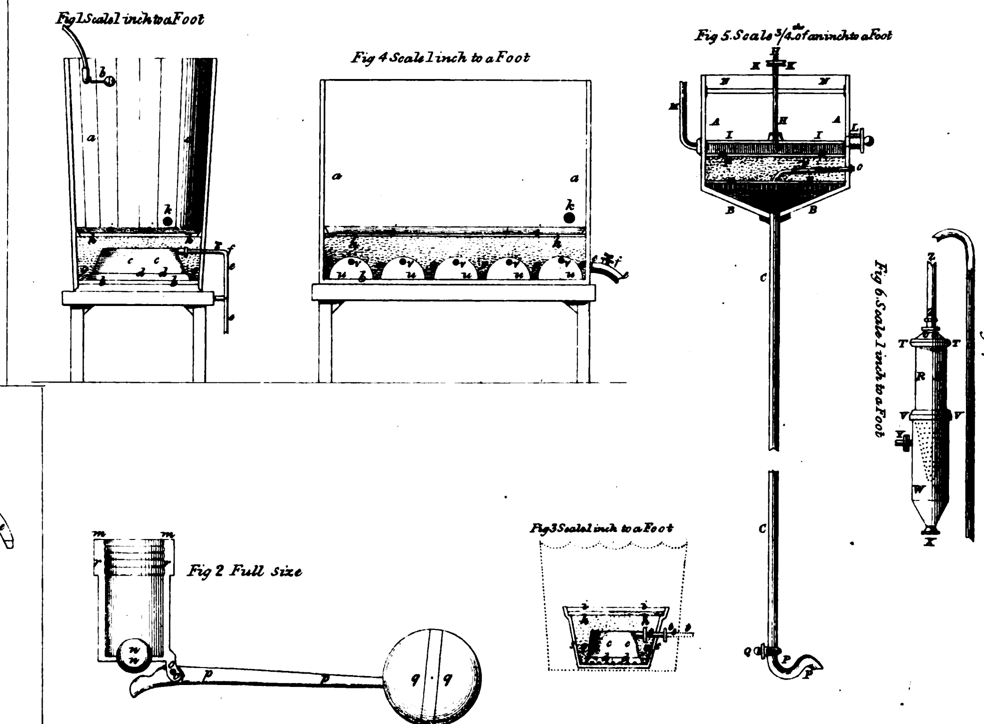
To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said James Neville, do hereby declare, that the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained in and by the following description hereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

Description of the Drawing.

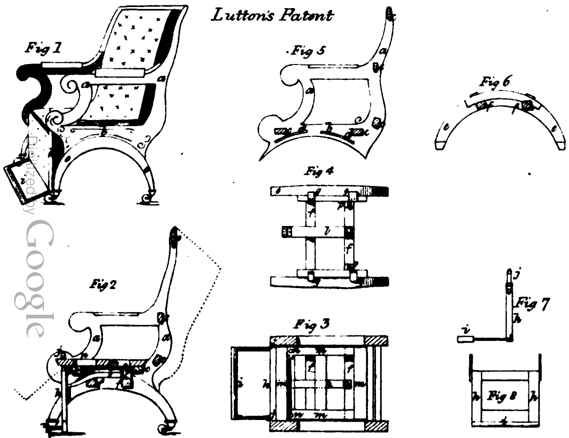
Fig. 1, represents a vertical section of my improved apparatus for clarifying water. *a, a,* is a vessel, cask, or other reservoir, made of wood or any other suitable material, on the bottom, *b, b,* of which I place the pan, *c, c,* which is made of porous or unglazed earthenware, and is of a conical or dished form, inverted or placed mouth downwards; the rim or mouth of this pan has a number of notches or apertures to admit of the free passage of the purified water, and I cement or tie a strong slip of felt, *d, d,* round the mouth or lower rim of the said pan, *c, c,* in order to prevent any minute particles of the filtering or clarifying medium from passing or entering into the said pan, *c, c,* at the top of which the pipe, *e, e,* communicates with the interior of said pan for the purpose of drawing the clarified water therefrom; this pipe passes through the side of the vessel or reservoir, *a, a,* and where the situation of the said reservoir will admit of it, I carry the said pipe, *e, e,* as low as possible, in order to obtain greater atmospheric pressure on the surface of the fluid contained in the vessel or reservoir, *a, a,* by which means a greater quantity of water will be forced through the clarifying medium; in such case I employ a small valve, *f,* which is at liberty to rise and allow any air that may be contained in the descending or delivering pipe, *e, e,* to escape; but where the situation will not admit of such descending pipe, I merely employ a common tap, or cock, communicating by a short pipe with the interior of the pan, *c, c,* for the purpose of drawing the water therefrom. The pan, *c, c,* in the reservoir, *a, a,* is first surrounded with a layer or stratum of coarse silicious grit or sand, *g, g,* to the height of two or three inches, on the surface of which there is a bed of vegetable charcoal, *h, h,* which has been reduced in a proper mill to the fineness of coarse ground coffee, and from which all the impurities have been extracted by repeatedly boiling it in pure water:

Neville's Patent





Lutton's Patent



London Simpkin & Marshall. for the Proprietor June 1.1834.

this bed of charcoal rises several inches above the top of the pan, *c, c;* it is compactly rammed down and the surface levelled; over, or on, which is laid a piece of thick woollen felt, and thereon a slate, *i, i,* which nearly fits the area of the reservoir or vessel, *a, a:* this slate, *i, i,* (or other covering) is intended to protect the filtering medium from being disturbed either in the operation of cleansing the apparatus from an accumulation of mud or other impurities, or from the sudden or violent flow or fall of water thereon, at the same time there is a sufficient space left between the edges of the slate (or other covering) and the sides of the vessel or reservoir, *a, a,* for the passage of the water over the surface of the felt, which latter is nailed or cemented to the sides of the said vessel or reservoir. When this apparatus requires cleansing, it is to be done by scouring it round with a broom or mop, and opening the tap or orifice, *k,* to allow the foul water, &c., to escape.

In order to regulate the supply of water to this apparatus, where it is fed from a service-pipe or main, or from any cistern or other feeder, I employ a more simple and effective instrument than the ball-cock now in use; this is shewn by *l,* in fig. 1; and fig. 2, represents a full-sized section of the same. *m, m,* is a metal tube having a bottom which is perforated with a hole of smaller diameter, the same being counter-sunk so as to admit of a common Dutch or other marble, *n, n,* to bed itself therein, and to protrude about one-third of its diameter through or beyond the said aperture to the joint, *o, o*: the lever, *p, p,* is affixed, having a small hollow sphere, *q, q,* at the extremity; this lever and sphere are at liberty to rise and fall on the joint, *o, o,* and their weight should be sufficient to raise the marble, *n, n,* against the pressure of the water in the service-pipe, &c., at the same time the hollow sphere, *q, q,* should be sufficiently buoyant, when half immersed in water, to raise the lever, *p, p,* and thereby permit the marble, *n, n,*

to descend and close the aperture, or stop the current of water, whereby the supply will be regulated according to the required consumption: on the interior of the tube, *m*, *m*, is cut a female screw or worm, *r*, *r*, whereby it may be firmly screwed on the leaden service-pipe, without the necessity of soldering. The marble (being stone) will never be liable to be set fast from any corrosion of the metallic base on which it rests.

Fig. 3, represents an apparatus to be applied to cisterns, or water-butts, or other reservoirs, already erected, for purifying the water contained therein. This apparatus is precisely the same in principle as that described in fig. 1, and the same alphabetical letters refer to the same arrangements or respective parts, except that *s*, *s*, is an earthen pan or vessel of sufficient capacity to contain the filtering or purify medium, &c., as described in fig. 1; and that it is placed in the bottom of any cistern or water-butt, which is represented by the dotted lines in said fig. 3, a communication being made with the pan, *s*, *s*, by means of the dotted pipe, *t*, *t*.

Fig. 4, represents a tank or cistern for purifying water on a large scale, for manufacturing or other purposes. On the bottom of the tank, *a*, *a*, I place a number of semi-cylindrical or arched earthen pans, *u*, *u*, *u*, *u*, *u*; these run the whole length of the tank or cistern, at one extremity of which there is a communication, *v*, *v*, *v*, *v*, *v*, from each set of arched pans with the main-pipe, *e*, *e*, for the purpose of drawing the clarified water therefrom: this pipe I carry as low as the situation will admit of, as described in fig. 1; but where that cannot be done, I attach a pump thereto for drawing the water in greater quantities through the clarifying medium; in other respects the arrangement is similar to that described in fig. 1, and the same alphabetical letters refer to the same parts, except that in this apparatus the lower stratum, *g*, *g*, is composed of Kentish rag or any other very porous stone, broken small, and the stratum, *h*, *h*, is

composed of fine charcoal and well-washed sand mixed together, in equal quantities.

Fig. 5, represents a vertical section of my improved apparatus for clarifying malt liquor, oils, &c. &c., in large quantities. A, A, is a cast iron, or other cistern, open at top, and having a bottom, B, B, of a hopper shape, from the centre of which the pipe, C, C, descends about twelve feet. D, D, is a cast iron or other grating or false bottom, perforated with holes, which rests on the inclined or sloping sides of the bottom, B, B: this grating is covered with wove brass or copper wire gauze, on which is laid a sheet of fine chamois or wash-leather, E, E: on the surface of the latter is a bed of pure ground charcoal, F, F, and thereon is placed a frame G, G, which fits exactly the interior of the cistern, A, A; the said frame, G, G, being covered with a thick woollen felt; from the centre of the said frame, G, G, the revolving shaft or axis, H, H, rises, on which there are a set of brushes or agitators, I, I; and motion is to be communicated thereto from the pulley, K, K, or in any other manner whereby the sediment or impurities contained in the liquid intended to be purified will be kept suspended therein, or be prevented from accumulating on the surface of the felt or other covering of the frame, G, G. L, is an aperture and valve for allowing such sediment or impurities to escape when required; and M, is a pipe for supplying the fluid to the apparatus. Where such is malt liquor, or any other liquid subject to injury from exposure to the atmosphere, I use the floating cover, N, N, which exactly fits the interior of the cistern, A, A: the edges of this cover are lined with leather, or other substance, so as to render it air-tight, at the same time that it is at liberty to rise and fall as the fluid is supplied or withdrawn. The shaft or axis, H, H, passes through the centre of the said cover, N, N. O, O, is a small pipe, furnished with a valve, to allow the air contained in the pipe, C, C, and in the lower part of the cistern to escape. The lower end of pipe,

C, C, is curved, as shewn at P, P, which will prevent the admission of any air, when this machine is in action. If the descending-pipe, C, C, of this apparatus be twelve feet long, and the cistern, A, A, be four feet square (or containing a surface of sixteen superficial feet) when the said pipe is filled with any fluid of the specific gravity of water, then when the cock, Q, is turned, or opened, the atmosphere will act on the surface of the fluid contained in the cistern, A, A, with an immense force or pressure of more than five tons, or about eleven thousand six hundred pounds weight, whereby a large quantity of the fluid will be driven through the clarifying medium in a short time: the force or pressure thus obtained will always depend on the altitude of the apparatus here described (or the depth of the descending-pipe, *c*, *c*,) and the specific gravity of the fluids operated on; and I vary such altitude and consequent pressure according to the nature of the fluid so operated on, and the force necessary to effect its clarification in large quantities.

Fig. 6, represents a portable apparatus for fining or clarifying malt liquor, wine, &c.; and for the first-mentioned purpose it is intended for the use of publicans, &c., and to be attached to their present beer-engines, so as to enable them to fine or clarify their malt liquor in small quantities, or during the operation of drawing and vending it. R, R, fig. 6, is a cylindrical vessel, made of malleable zinc (or any other material) the lower part of which terminates in a cone, S, S. This cone is perforated with a number of holes, similar to a cullender or grater, as shewn by the dots thereon, over which is drawn a covering of thin chamois or wash-leather. This cylinder and cone are filled with pure ground charcoal (prepared as described in fig. 1); and at T, T, there is a screwed joint to admit of the conical cap, U, U, being screwed thereon, previous to which there is a circular piece of chamois leather laid on the surface of the charcoal contained in the cylinder, R, R, which is firmly screwed down by the

conical cap, U, U, and which will prevent any of the clarifying medium from rising: at the bottom of the cylinder, R, R, and where the cone, S, S, commences, there is another screwed joint, V, V, on which the external cylinder, W, W, is screwed: this external cylinder has a conical bottom, at the apex of which there is a plug or valve, X, for cleansing or discharging any impurities or sediment that may accumulate in the side exterior cylinder, W, W, on the side of which there is a nozzle and screw-joint, Y, for connecting the suction or service-pipe, which conveys the liquor from the cask or butt. At the top of the cone, U, U, is a union screw-joint for connecting the pipe, Z, Z, which leads from the beer-engine to this apparatus; and, where required, I attach several pipes from this apparatus to several distinct casks or butts, and to the respective pumps of such beer-engine where the malt liquor to be drawn is of the same denomination.

For clarifying or fining wines, instead of a pump being employed for drawing the liquor through this apparatus, I prefer the uniform and constant action of a syphon, fig. 7, which is screwed on to the top of the cone, U, U, and the descending-leg of this syphon, 1, 1, must be of sufficient length to cause the required draught or pressure of the fluid through the clarifying medium. Near the bottom of the syphon, fig. 7, is a stop-cock, and all the air must be exhausted from the said syphon and apparatus before they will act The syphon is to be inserted in a cask, &c., to receive the clarified fluid, leaving only the vent-peg open; and the service-pipe at Y, is to be attached to the cask or vessel containing the unclarified fluid, the vent-peg of which must also be left open; and the operation of fining may procceed as slowly as required. This apparatus may be effectually cleansed and kept in order, by unscrewing the joints, T, T, and V, V, when the chamois leather may be taken off, washed, and dried, when this apparatus is not in constant use.

I have given a scale to each separate figure, which will

furnish the relative proportions for all practical purposes; but I do not confine myself to the said dimensions, or to the peculiar forms described, nor to the particular metals or materials enumerated in the foregoing description; and I disclaim as being new or as forming any part of my said invention, the use of charcoal, stone, or sand, as a clarifying or filtering medium, the same having been known and acted on for half a century at least.—In witness whereof, &c.

Erolled March 9, 1832.

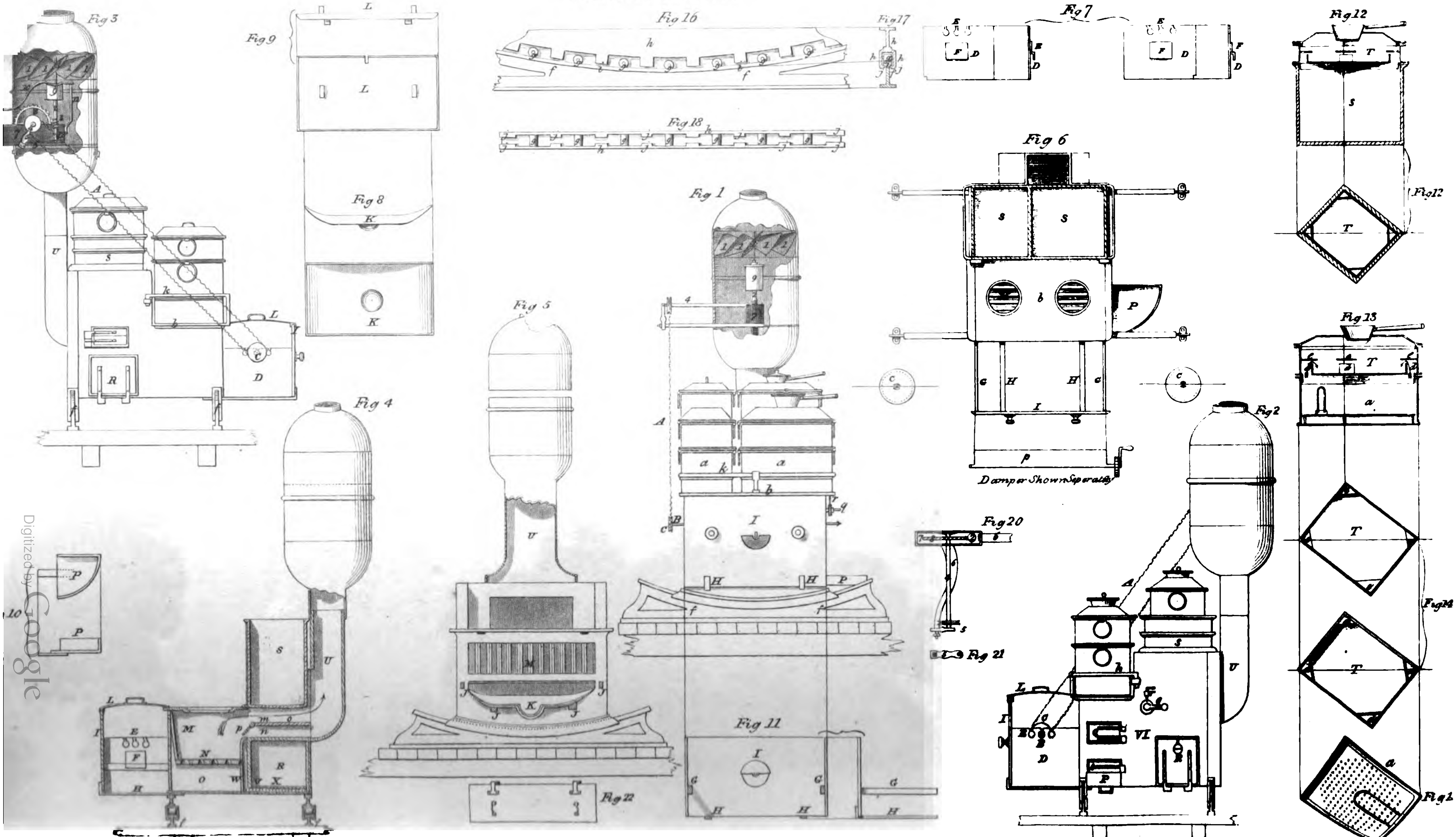
Specification of the Patent granted to JOHN WALLACE, *Brazier, in Leith, for an Improvement or Improvements in the Safety-Hearth.*—Sealed March 31, 1831.

WITH AN ENGRAVING.

To all to whom these presents shall come, &c. &c.—*Now know ye,* that in compliance with the said proviso, I, the said John Wallace, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained, in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say):

My improvement or improvements in the safety-hearth consists, First, in suspending or placing safety-hearths on a fixed stand or frame, such framing forming a curved railway, whereby the safety-hearth will, by its gravity, always keep its perpendicular position, even at the time of the ship's heeling. Secondly, in a particular application of a damper, for the purpose of changing the direction of the heated hair and flame. Thirdly, in applying a smoke-jack in the flue or chimney of a safety-hearth, and by means of certain other additions, hereafter shewn and described, forming a ship's safety-hearth capable of

Wallace's Patent.



London . Simpkin & Marshall for the Proprietor June 1 1824

roasting meat by the power derived from such smoke-jack.

Description of the Drawing.

Fig. 1, is a front view of a safety-hearth, having my improvements applied thereto, and being the principal figure in the drawing referred to, I shall be the more particular in the description of it. It consists of the frame, boilers, and cooking apparatus attached thereto; also a smoke-jack for roasting, which jack, although in itself it forms no part of my invention, I deem it necessary to explain, as connected with my safety-hearth, in so far as I have introduced it for this purpose, and I have substituted figures instead of letters, to denote the particular parts of it as follows: in fig. 1, which, as well as fig. 3, is supposed to have part of the bulb or cylinder, composing the upper part of the flue or chimney, removed in order to shew more clearly the internal construction of the smoke-jack, 1, 1, 1, &c., is a horizontal fan, composed of six or more vanes or leaves, attached to an upright axis, 2; it occupies the whole internal diameter of the bulb or cylinder, and about one-fourth of the depth of the straight part of it. 2, the upright axis which runs up in the centre of the cylinder, and is driven round by the smoke acting upon the inclined vanes of the fan in its ascent up the flue from the furnace. 3, is a spiral or endless screw, cut upon the upright axis, 2, which drives a brass cog wheel, consisting of about forty teeth, seen in fig. 3. 4, is the axis of this brass wheel, having a pulley near its end for receiving a chain to turn the spit, and runs in a centre made in the bar 5, which I call the pivot rest, drawn separately, in fig. 21. 6, is an iron arm, on which several parts of the jack are fixed, more clearly seen in the bird's eye view, fig. 20, and in this figure the pivot rest 5, is attached at its extreme end, to keep it in its place. 7, is an oil box, the end of which is only seen in this figure, resting upon the bar, 6, but it is best seen in fig. 3.

Fig. 3, is an end view, in which 6, is still farther explained; it is here seen lengthways, and is turned down at each end, and secured to the cylinder, by two screw-bolts, as indicated by the drawing. 7, the oil box already referred to: it is made of cast iron, or other suitable material, and is supposed to have the side next the observer removed in order to shew how the upright axis moves in the bottom of it in a centre; it is introduced into the side of the cylinder by a hole cut for it, and projects out from the side, and it also projects at the other end, a little beyond the centre of the cylinder, for the purpose of fixing a piece of metal, 13, through which the upright axis descends, and this piece of metal, 13, acts as a guide, in case (if by any accident) the axis should come out of the centre. 8, is the wheel acted upon by the endless screw, 3, and having at the end of its axis or pulley, best seen in fig. 1. Opposite this wheel the pivot rest is best seen, being fixed obliquely that the chain may not be interrupted, which it would be if placed perpendicularly. 9, is another oil box of a cylindrical form, to contain oil to lessen the friction on the axis. 10, is an arm for the upright axis to work in, it is bent down a little into the oil box, to come in contact with the oil, and is fixed on another arm, 11, by a screw nut. 11, is an upright arm attached to the oil box, by a screw bolt, or other means. 12, is another arm for fixing the other end of the arm, 10, and it is also fixed to the oil box in the same manner as 11.

Fig. 20, is a bird's eye view of the cylinder, in which the position of the wheel 8 is seen fixed on its axis; this axis is passed through a hole in the side of the cylinder, and the other end moves in a piece of iron, fixed on the inside of the oil box 7. 2, is the centre of the upright axis; the relative position of the iron arm 6, the axis 4, and the pivot rest 5, and the pulley are here seen.

Fig. 21, is the pivot rest, having a square hole at the one end, for taking on to the bar 6, and a round hole at

the other end, for the axis 4 to move in; in this figure the arm 6 is also represented as passed through the cylinder by a hole made for the purpose; it is made strong for holding the pivot-rest firmly. I may here state that I occasionally use a cover for the brass wheel and spiral or endless screw, which cover rests upon, or is attached to, the oil-box. I have also a cover which is applied over the projecting end of the oil-box, with a space between the said cover and the oil-box, for the admission of cool air into the jack apparatus, to prevent it, as much as possible, from being dirtied and injured by the hot vapour and smoke, which impel it in its ascent up the flue. Although this is not absolutely necessary, yet I would recommend the use of such covers to the jack, particularly in distant voyages, and where there is a large ship's company.

Fig. 4, is a side-section of the ship's hearth; and

Fig. 5, is a front-section, having the cover or upper part of the flue or chimney removed, in order to admit the smoke-jack being put into its place.

Fig. 6, is a plan, with some of the parts removed, whereby the construction will more readily be seen. In all these figures the same letters of reference indicate similar parts, and such is also the case with reference to the other figures shewn in the drawing.

On the cylinder, figs. 1, and 3, there is a pulley affixed for receiving and driving an endless chain, A, for turning the spit, B, which is formed similarly to those commonly employed. C, is a pulley affixed to one end of the spit, which receives motion, and is actuated by the endless chain, A. D, D, are the two side-plates, which have gaps or slits, E, cut into them, for the purpose of receiving the spit. F, F, are the hooks by which they are affixed in their proper places, and are supported and retained by the bars or rods G. These side-plates are seen separately in fig. 7, and in their places in figs. 2, 3, and 4. The

bars or rods, G, and rods, H, are affixed to the front-plate, I, and slide in holes, J, fig. 5, cut into the framing of the ship's hearth. The rods, G, support the side-plates, D, D, and the rods, H, support the dripping-pan, K, which dripping-pan is shewn separately in fig. 8, and in its place in fig. 5.

Fig. 9, L, is a cover which rests on the front-plate, I, and on the front on the fire-place, as shewn in figs. 1, 2, and 3. The object of the rods or bars, G, H, sliding into the holes, J, is, that the slide-plates, D, D, the spit, B, dripping-pan, K, and cover, L, may be removed, and the front-plate, I, shut against the bars of the grate or fire-place, when roasting is not going on; previous to which a metal plate, fig. 22, is put over the front-grate to prevent the cold air from passing between the top of the fire. This metal plate is fixed by two pieces of iron, as represented thereon, by two holes made in the frame to receive them, and it slips out and in at pleasure: it has also two handles to lift it by. M, are the front bars or grating of the fire-place, which I prefer to be in nearly a vertical position; they are seen in figs. 4, and 5; and the bottom grating or fire-bars, N, are shewn in figs. 4, and 6. O, figs. 2, and 4, is the ash-pit; and P, is a pan or trough to receive the ashes from the ash-pit, such pan being shewn separately at fig. 10. Q, fig. 2, is the door for feeding the fire with fuel.

Fig. 11, shews an inside view of the front-plate, I, and also a side-view of the same, separately. R, is the oven which runs from side to side, having a door at each end, as shewn in figs. 2 and 3. S, S, are two boilers, one of which is shewn in section and in plan separately at fig. 12, together with a section of the steaming-vessels, T; but such steaming-vessels being well understood, and forming no part of my invention, and as their shapes are clearly shewn in the figures of the drawing, no further description will be necessary. *a*, *a*, are two boilers, which are placed over the fire-place, and on the top or

hot plate, *b*, in which there are two openings cut for the purpose of putting in a saucepan when the boilers are not on the top: these openings are covered at other times with the circular plates, *c*. One of the boilers, *a*, *a*, is shewn separately at fig. 13, having its steaming apparatus, T, at top; but when steaming is not required the covers are made to fit the boiler, *a*, and the steaming apparatus may be removed.

Fig. 14, shews two plans at the bottom of the steaming apparatus, T; *d*, *d*, *d*, *d*, being the openings formed in the corners for the steam to pass through; and *e*, *e*, *e*, *e*, are the top to turn the steam downwards in the direction of the arrows.

Fig. 15, shews a plan of the boiler, *a*, having a perforated plate, or stainer, for taking out fish or other substances boiled in the boiler, *a*.

In figs. 1, 2, 3, 4, 5, and 6, the safety-hearth is shewn as placed on a curved stand, or frame, which forms a railway upon which the hearth can move from side to side, in case of the heeling of the ship or vessel, and whereby the hearth will be kept in its perpendicular position. The construction of this frame will be clearly understood by an examination of fig. 16, in which figure, as well as in the other figures above named, *f*, represents the frame, or rails, on which the hearth is placed; the frame or rails, *f*, being strongly fixed to the deck or flooring of the ship or vessel, by bolts or screws (as is shewn in fig. 6). *g*, *g*, are friction-rollers affixed to the part, *h*, of the framing, which is attached to the under-side of the safety-hearth. The form of this part, *h*, will be clearly understood by examining fig. 16, and also fig. 17, which is a cross-section, and fig. 18, which is a view of the under-side of the parts, *h*, and the friction-rollers, *g*, *g*. The upper parts of the frame or rails, *f*, have projecting edges, *i*, *i*, see fig. 17; and the under parts, *j*, of *h*, are turned inwards, and this prevents the safety-hearth being thrown off the framing or rails, *f*. *k*, is a bar passing

around the boilers, *a*, to retain them in their places. *m*, *n*, fig. 4, are the flues passing from the fire to the chimney, U; *m*, being the flue under the boilers, s, s, and *n*, being the flue which passes over the oven: these flues, *m*, and *n*, are divided by an iron plate, *o*. *p*, is a damper, which may be made to turn on its axis by the handle, *q*, figs. 1, and 2, and retained in any position, by the sliding-catch, *r*, entering into a notch cut in a wheel affixed on the axis of the damper, *p*, as shewn in the drawing; and by this means the fire may be damped off from the boiler or the oven; or by placing it horizontally, the fire may be made to act on the top of the oven and at the bottom of the boilers. V, fig. 2, is a hole cut through the side of the hearth for the admission of air, which passes into the chamber, W, at the back of the fire-place, and thereby becomes heated; from thence it passes under the front of the oven at Y, into the space which is beneath the perforated plate, X, which extends the whole length of the oven; and under this perforated plate, X, the space is filled with sand so that the heated air from the chamber, W, mixes therewith and heats it, and thus I am enabled to get a bottom-heat to the oven.

Having now described the various parts represented in the drawing, I would have it understood, that, although I have shewn and described various parts which are well known and in use, yet I do not claim them as any part of my invention. What I claim is, First, the placing or mounting of a safety-hearth on a curved railway, whereby it will be kept in its perpendicular position in case of the heeling of the ship or vessel. Secondly, I claim the application of the damper, *p*, and double flue, whereby the fire and flame may be shut off from the boilers or ovens when not in use, whether they be applied separately or together, in a ship's hearth. Thirdly, the application of a smoke-jack to the chimney or flue of a safety-hearth, and the other additions whereby such safety-hearths are made capable of roasting by means of

the power derived from such smoke-jack.—In witness whereof, &c.

Enrolled September 21, 1831.

Specification of the Patent granted to Charles Joseph Hullmandel, *of Great Marlborough Street, in the county of Middlesex, Printer, for a certain Improvement in the Art of Block Printing as applied to Calico and some other Fabrics.*—Sealed October 28, 1833.

To all to whom these presents shall come, &c. &c.—*Now know ye*, that in compliance with the said proviso, I, the said Charles Joseph Hullmandel, do hereby declare the nature of my said invention to consist in doing away with many of the difficulties and inaccuracies of that part of the process of blocking printing called "putting on," and lessening the time usually occupied therein, by applying a certain mode of engraving and printing thereto. And in further compliance with the said proviso, I, the said Charles Joseph Hullmandel, do hereby describe the manner in which my said invention is to be performed by the following statement thereof (that is to say):

Having procured an original pattern, as drawn by the artist, I place upon it a sheet of that transparent substance made from isinglass or gelatin, known by artists and sold in Paris by the name of papier glace, and in London by the name of glass paper; I then take a fine sharp tracing-point, and make a tracing of the pattern in such manner as to form, in fact, an etching or incised outline on the papier glace; this done, it will be found that the tracing-point has raised a slight burr on each side of every line, this must be removed by a sharp scraper lightly passed over the surface of the papier glace: when this is done, the papier glace is to be treated as an engraved copper plate, and having been

inked with printer's ink, and cleaned off in the usual way, an impression must be thrown off from it upon thin oiled silk, by means of an ordinary roller-press, care being taken that the papier glace should be uppermost, or next to the roller, and the oiled silk undermost, or on the bed of the press. The impression thus obtained on the oiled silk is to be turned down on the block and transferred to it by slightly rubbing it on the back. The same piece of papier glace will give off a great number of impressions; and thus by having numerous pieces of oiled silk, with one person to attend the press and one to transfer to the block, an often-repeated pattern may be put on, as it is called, in a very few minutes; and the hand of the artist now required to redcaw and complete the present blurred impression on the block, by making a perfect outline with a brush and carmine, entirely superseded. It should here be stated, that the papier glace will not bear any application of water to its surface, and that all the inks used for impressions to be taken from it must therefore be what are termed fatty inks; and as it is necessary, in the process of putting on, sometimes to use different colours for different parts of the outline, as also, on certain occasions, to use colour which will withstand the wetting which the block has sometimes to undergo, I shall now proceed to name several inks suited to that purpose, which, though they form no part of my said invention, will nevertheless enable the manufacturer to make use of my said invention to greater advantage, and in a more extensive way.

Instructions for Making the said Inks.

Take some varnish (burnt linseed oil), mix with it a little tallow and some sweet oil,—lay this by for use.

For Red Ink.—Mix some of the above with as much carmine as it will take; the stiffer the ink is made by adding colouring matter, the sharper the impression will be. Previous to throwing off or transferring the im-

pression to the block, the latter must be well washed with a solution of caustic potash or soda, and allowed to dry; and be it recollected, that with this ink, as well as with all the following, immediately or some time after the impression is taken, a sheet of clean paper must be put over or laid on the block, and a hot iron run over it to fix the ink: while the wood is still hot, pour over it a solution of allum; and if the yellow tinge produced by the caustic, potash, or soda, still remains, and it is wished to be removed, a weak solution of muriatic acid will effect the purpose. You may, in grinding this ink, add a small portion of dry soap.

For Black Ink.—Take about equal parts of nitrate of silver, commonly called luna caustic, and varnish, add a little lamp black, merely to colour the ink, and grind the whole well on a glass or marble slab. For this ink the block may or may not be washed with a solution of caustic, potash, or soda. When the block is washed with a solution of wax in turpentine varnish and lamp black only may be used for throwing off impressions: when this solution is adopted, do not use a hot iron after the transfer is finished, but merely hold the black near to the fire, this will fix the pattern.

For Blue Ink.—Grind equal parts of green sulphate of iron, dried over the fire, and common red ochre, or any colour containing iron (add a little indigo to give colour to the ink) with varnish. Wash the block with prussiate of potash, and caustic soda, or potash. After the impression has been fixed with a hot iron, pour some muriatic acid (diluted) on the whole (do not use a brush for this operation or the lines will smear) to bring out the colour.

For Blue Ink with Indigo.—Grind very fine some indigo with varnish, and, if thought proper, some yellow orpiment. Wash the block with a solution of caustic potash.

Now it is evident that my said invention is applicable

to all those styles of block printing, where the process called "putting on," is used, and various modes of availing himself of it, in the whole or in part, will occur to the manufacturer, which it would be unnecessary here to enumerate; thus, for instance, when part of the pattern is made from engraved rollers, the remainder may be traced on papier glace; or where the brassed blocks, as they are called (the putting on of which has been performed as aforesaid) are used, an impression may be taken from them on fine oiled silk, and then such parts of the pattern as are to be transferred to blocks may be outlined by hand on the silk with the aforesaid inks, and the silk then turned over on the block, and an impression given of the pattern on the block, without the ordinary hammering or blows on the back of the block. Another great advantage of this mode of proceeding as regards brassed blocks, is, that though the whole brassed pattern will be given on the oiled silk, only so much as is necessary to guide the cutter will be transferred to the other block, which will cause much less confusion to the cutter. It is only necessary further to add, that the papier glace (if that be the transparent substance used) should be kept in a dry place, and when engraved, if laid by, will serve to renew the pattern at a very short notice, at any time when required, and when no longer wanted may be melted up and formed into new sheets of papier glace.

Now whereas, I claim as my invention, etching or scratching a copy of the pattern to be used in block printing on a transparent substance, such as the said papier glace, while placed over the original pattern drawn by the artist, and then by means of coloured inks suited to the transparent substance used for the etching, as also to the wetting of the blocks when cutting; throwing off a print from the etching in an ordinary copper-plate printing-press, in manner aforesaid, upon a thin oiled silk, and transferring the same on to the block while the ink is wet, by turning that side of the silk containing the

impression over on the block, and applying slight friction and pressure to the back of the silk, as aforesaid. And such my invention being, to the best of my knowledge and belief, entirely new and never before used within that part of his said Majesty's United Kingdom of Great Britain and Ireland, called England, his said dominion of Wales, and town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply, fully and without reserve or disguise, with the said proviso in the said hereinbefore in part recited letters patent contained; wherefore I do hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled April 28, 1834.

ORIGINAL AND SELECTED PAPERS.

A Rule for ascertaining the Diameter of a Hollow Cylinder which shall contain the same quantity of matter as a given Solid Cylinder.

To the Editor of the Repertory.

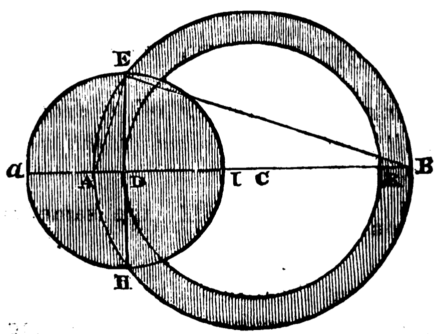
Sir,

Tredgold, in his excellent Treatise on the Strength of Cast Iron, page 128, 2nd edition, gives a ready method, by geometrical construction, for ascertaining the radius of a solid cylinder that will contain the same quantity of matter as the tube or hollow cylinder. However it more frequently happens, that in practice you require to find the diameter of a hollow cylinder that shall contain the same quantity of matter as a given solid cylinder, the breadth of the circular ring being given, a rule for which I have not yet been able to discover in any work extant. If you think the following rule worthy insertion in your valuable work, it is at your service, and I have no doubt it will be found of utility to

those who are in the habit of using cast iron, particularly when it is considered, that the strength of a column or shaft is doubled by expanding the matter into a tube, care being taken not to have the ring less in breadth than three twentieths of the diameter, otherwise the tube would not be capable of retaining its circular form: three twentieths ought to be the extreme. If d, be the diameter of the solid cylinder then 0.98 equals the lesser, and $1.4\,d =$ the greater diameter of the hollow cylinder, when the strength is doubled.

Problem. Given the area and breadth of a circular ring to find the diameters of its bounding circles.

Construction. Let the circle E G H I be equal to the area proposed. Through the centre D draw the the diameters G I and H E cutting at right angles in D: make D A equal to the given breadth, and join A E. From E draw E B perpendicular to A E meeting G I produced in B: bisect A B in C, then is C the centre, and C A, C D the radii of the bounding circles.



Calculation. The triangles A D E and A E B are similar (Eucl. 6.8.): therefore,

$$\text{AD} : \text{AE} :: \text{AE} : \text{AB} \quad \text{(Eucl. 6.4.)}$$

But $\text{AB}^2 = \text{AD}^2 + \text{DE}^2$ (Eucl. 1.47.) Hence we have

$\text{AE} = \sqrt{\text{AD}^2 + \text{DE}^2}$ by evolution, and the analogy becomes $\text{AD} : \sqrt{\text{AD}^2+\text{DE}^2} :: \sqrt{\text{AD}^2+\text{DE}^2} : \text{AB}$ that is

$$\text{AB} = \frac{\text{AD}^2+\text{DE}^2}{\text{AD}} \text{ or } \text{CA} = \frac{\text{AD}^2+\text{DE}^2}{2\text{AD}}$$

and $\text{CD} = \text{CA} - \text{DA} = \dfrac{\text{DE}^2 - \text{AD}^2}{2\text{AD}}$ Whence we have the following.

Rule. Divide the sum and difference of the squares of the radius of the given circle and breadth of the ring by twice that breadth for the radii of the greater and less bounding circles respectively.

Example. Suppose the area of the ring or its equivalent circle EGHI to be 201.0624 inches, then will its radius $DE = \sqrt{\frac{201.0624}{3.1416}} = \sqrt{64} = 8$ inches; and suppose the breadth of the ring to be 1.5 inches. Then will $AE = \sqrt{66.25} = 8.1394$ inches, then by the preceding analogy we have

$$1.5 : 8.1394 :: 8.1394 : 44\tfrac{1}{6} = AB \text{ and}$$
$$44\tfrac{1}{6} - 3 = 41\tfrac{1}{6} = DR$$

Wherefore $CA = 22\frac{1}{12}$ and $CD = 20\frac{7}{12}$.

But to perform the same thing by the rule we have

$$DE^2 = \frac{201.0624}{3.1416} = 64$$
$$AD^2 = \ \ 1.5 \quad = 2.25$$
$$\text{Sum} = 66.25$$
$$\text{Diff.} = 61.75$$
$$2\,AD = 3 \text{ therefore}$$

$CA = \frac{66.25}{3} = 22\frac{1}{12}$ and $CD = \frac{61.75}{3} = 20\frac{7}{12}$ the same as before.

Otherwise algebraically:

Put a = the given area, b = the breadth of the ring, $\varphi = .7854$ and let x represent the outer diameter. Then will $x - 26$ = the inner diameter, and

$$46\,\varphi\,(x - b) = a \text{ by the property of the circle.}$$

Therefore $x = \frac{a}{46\,\varphi} + b$ = the greater diameter, and

$\frac{a}{46\,\varphi} - b$ = the less. But $4\,\varphi = 3.1416$.

Wherefore the expression for the diameters is

$$\frac{a}{3.1416\,b} \pm b. \text{ That is}$$

Divide the given area by 3.1416 times the breadth, and the sum or difference of the quotient and breadth will give the greater or less diameter accordingly, being a rule preferable to the one derived from the construction. Or, divide the square of the diameter by four times the breadth, and the quotient increased or diminished by the breadth will give the diameters.

I am,

Winsley Street, Your obedient Servant,

May, 1834. G. COTTAM.

On the Manufacture of Oil and Spirit Varnishes, Gold Lackers, Gold Size, &c. By J. WILSON NEIL, 21, King's Cross, Battle Bridge.

[*Concluded from our last, p.* 310.]

Pale Amber Varnish.

Fuse six pounds of fine-picked, very pale transparent amber in the gum-pot, and pour in two gallons of hot clarified oil. Boil it until it strings very strong. Mix with four gallons of turpentine. This will be as fine as body copal, will work very free, and flow well upon any work it is applied to; it becomes very hard, and is the most durable of all varnishes; it is very excellent to mix in copal varnishes, to give them a hard and durable quality. *Observe,* amber varnish will always require a long time before it is ready for polishing.

Best Brunswick Black.

In an iron pot, over a slow fire, boil forty-five pounds of foreign asphaltum for at least six hours, and during the same time boil in another iron pot six gallons of oil which has been previously boiled; during the boiling of the six gallons introduce six pounds of litharge gradually, and boil until it feels stringy between the fingers; then ladle

or pour it into the pot containing the boiling asphaltum. Let both boil until, upon trial, it will roll into hard pills; then let it cool, and mix it with twenty-five gallons of turpentine, or until it is of a proper consistence.

Iron-work Black.

Put forty-eight pounds of foreign asphaltum into an iron pot, and boil for four hours; during the first two hours introduce seven pounds of red lead, seven pounds of litharge, three pounds of dried copperas, and ten gallons of boiled oil; add one eight-pound run of dark gum, with two gallons of hot oil. After pouring the oil and gum, continue the boiling two hours, or until it will roll into hard pills like japan. When cool, thin it off with thirty gallons of turpentine, or until it is of a proper consistence. This varnish is intended for blacking the iron-work of coaches and other carriages, &c.

A cheap Brunswick Black.

Put twenty-eight pounds of common black pitch, and twenty-eight pounds of common asphaltum made from gas-tar, into an iron pot; boil both for eight or ten hours, which will evaporate the gas and moisture; let it stand all night, and early next morning, as soon as it boils, put in eight gallons of boiled oil; then introduce gradually ten pounds of red lead, and ten pounds of litharge, and boil for three hours, or until it will roll very hard. When ready for mixing, introduce twenty gallons of turpentine or more, until of a proper consistence. This is intended for engineers, founders, ironmongers, &c.; it will dry in half an hour, or less, if properly boiled.

Another cheap Brunswick Black.

Put twenty-eight pounds of common pitch and twenty-eight pounds of gas-asphaltum into an iron pot; boil these for eight or nine hours; leave it until next morning; then bring it to a simmer, and gradually introduce seven

pounds of red lead and seven pounds of litharge, and continue it at a low heat while the oil is got ready. Put five gallons of boiled oil into the ten-gallon iron pot, and boil it until it will blaze inside the pot when a lighted paper is held over it. As soon as it will catch fire, carry it out into the yard, put a ladle into the burning oil, and move it gently from the bottom. In about ten minutes from its catching fire, have the iron cover ready, and boldly, but deliberately, step forward and clap on the cover, taking care to fit it so tight to the pot, that it will extinguish the flame in moment, which if it does not, lift the cover and try a second time, while the assistant throws the carpet over the cover, and holds it close for a minute; if that does not put out the flame, pour in cold boiled oil, of which there ought always to be two gallons in the pouring-jack ready at hand; then it will be easily extinguished by raising the cover. Continue setting it on fire and extinguishing it after the space of three or four minutes, until, when a little is poured into a mussel-shell and cooled, it looks as thick as treacle; it is then strong burnt oil. Before it is cool, ladle it into the asphaltum, and boil the whole for two hours, or until it will roll hard. When sufficiently cool, pour in twenty gallons of turpentine or more, until of a proper consistence. When this is properly managed, it may be made to dry in ten minutes.

Flock Gold Size.

Put twelve gallons of linseed-oil into the iron set-pot; as soon as it has boiled two hours, introduce gradually twelve pounds of litharge. Continue the boiling very moderately for six hours; let it remain until next morning; then bring it to simmer, and run ten pounds of gum anime and two gallons of oil. When these two runs of gum are poured into the iron pot, put in seven pounds of Burgundy pitch, which soon melt, and continue the boiling; and keep ladling it down, as before directed for the

best gold size; boil it moderately strong, but not over strong; and when proper, mix it with thirty gallons of turpentine, or more if required; but recollect, this should be left a little thicker and stronger than japanner's gold size. This is intended for and used by paper-stainers to lay their flock on, and ought to dry slowly in one hour.

Bronzing Gold Size

Is nothing more than japanner's gold size kept till very bright and tough from age, and then heated up and mixed with one gallon of very old carriage-varnish to nine gallons of gold size. This is used by paper-stainers for laying on bronze and also gold; and likewise by writers, grainers, japanners, gilders, &c.

Recollect, that the greater the proportion of carriage-varnish, the slower it will dry. Some paper-stainers like it to dry quicker than others; and writers and grainers like it to dry quicker than gilders and japanners.

Axioms observed in the making of Copal Varnishes.

The more minutely the gum is run, or fused, the greater the quantity, and the stronger the produce. The more regular and longer the boiling of the oil and gum together is continued, the more fluid or free the varnish will extend on whatever it is applied. When the mixture of oil and gum is too suddenly brought to string by too strong a heat, the varnish requires more than its just proportion of turpentine to thin it, whereby its oily and gummy quality is reduced, which renders it less durable; neither will it flow so well in laying on. The greater proportion of oil there is used in varnishes, the less they are liable to crack, because the tougher and softer they are. Increase the proportion of gum in varnishes the thicker the stratum, and the firmer they will set solid, and dry quick. When varnishes are quite new made, and must be sent out for use before they are of sufficient age, they must always be left thicker than if they were to

be kept the proper age, as some of the annexed experiments will prove.

Exp. I.

Of two well-got-up pannels, painted with patent yellow, I varnished the first with good body varnish twelve months old, the second pannel was varnished with body of the like quality only one month old. After both pannels were dry, on examining the first it was excellent; but that varnished with the new-made looked poor, flat, and sleepy, as it is termed.

Exp. II.

Of two pannels, both prepared and flatted down, the first I varnished with gold size, and the second with japan; both had only been made one month. The gold size dried in half an hour, and the japan in ten hours and twenty minutes. I then put both pannels into any empty drawer, where they remained for eight months. I then tried the same gold size and japan on two fresh pannels prepared exactly as the first, when I found the gold size much thicker, yet much paler, and it now dried in fourteen minutes; the japan also dried now in seven hours.

Exp. III.

That varnish made from African copal alone possesses the most elasticity and transparency, may be proved by the following facts. Three prepared pannels of a very pale straw-colour were all varnished in one day: the first with fine body varnish made from very pale gum anime; the second with fine body varnish made from one half anime and one half African copal; the third pannel was done with varnish made entirely from fine African copal. These three varnishes were all made with the greatest nicety for the experiment; all equal in their proportions and ages, having been all made in one day. At the time of varnishing the three pannels, the varnishes were all

eight months old. I filled three vials, one with each sort, and could discover no difference in the colour, either when held near to the eye or at a distance. Upon moving the vials, and turning them, the third, containing the African copal, appeared the most elastic. All the three pannels dried about the same time—eight hours. I hung them all three where they were exposed to sun, wind, and rain, for one month. I then examined them, and could perceive little if any difference in colour. I left them for another month, when, on examination, the first, made from anime, was the darkest, and that from the copal the palest. I then polished all three; the first polished very easily, the second not quite so easy, and the third was very difficult to polish, appeared very soft and clammy, but when completed was by far the palest and most transparent. I left them upon a roof exposed to the weather for three months, when I flatted them down a little, and varnished them afresh. In ten days after, I polished them, when the third, varnished with the African copal, was by far the palest, and looked like plate-glass.

EXP. IV.—*That too much Driers in Varnish render it opaque, and unfit for delicate Colours.*

One day I varnished two pannels, got up and glazed with a very rich crimson lake. No. 1, was varnished with body varnish, made entirely from African copal, without any driers whatever, either in the clarified oil or boiling. No. 2, was varnished with "body" of the same gum, age, and proportion, but with a small quantity of dried sugar of lead and dried white copperas. The pannel, No. 1, dried in nine hours, and remained tacky for five hours more; the panel, No. 2, dried in seven hours without a tack. In a day after, both pannels were flatted down and varnished, and repeated until each pannel had four coats of varnish; the varnish was eight months old, and each dried in the same space of time. I hung both up for a month, and then polished them, and examined

them with a microscope, when the pannel, No. 1, appeared quite clear in colour, solid, and brilliant, like plate-glass; but No. 2, had changed a little in colour, inclining to purple, and in the varnish were almost imperceptible opaque points. I kept these two pannels for two years afterwards; when I examined them, there appeared no decay in No. 1, but in No. 2, the driers were perceptible on the surface with the naked eye.

Exp. V.—*That moist Driers boiled in Varnish cause it to run in Pin-holes.*

To eight gallons of very fine African copal, during the boiling, I introduced half a pound of undried copperas and half a pound of undried sugar of lead. After the varnish had stood to settle for eight months, I varnished with it a pale patent yellow pannel; it floated very well, set and looked well for four hours, when it began to dry off in small pin-holes completely over the surface, some of the holes as large as the head of a pin. It dried off in seven hours without any tack.

Exp. VI.—*That the greater the Quantity of Driers and Acid, the larger the Pin-holes.*

I emptied six gallons out of the jar containing the last-named varnishes, then I varnished another pannel out of the two gallons remaining in the jar: the pannels dried in the same time, but went off not only into pin-holes, but into large blotches all over.

Exp. VII.—*That Particles either of Oil or cold Turpentine in the Varnish will create Pin-holes and Blemishes.*

To one gallon of body varnish, nine months old, which had been tried and found to be excellent, I introduced a quarter of an ounce of water and a quarter of an ounce of linseed-oil. I heated and mixed altogether, and poured it into a jar, and let it stand for three months, when I varnished two pannels, one yellow and the other light

green; four hours after, when I examined them, they were about half dry, and beginning to run into pin-holes and round empty holes. I examined them with a microscope, and found a particle of oil hanging to the lower edge of every circle, and the small particles of water had evaporated: the surface appeared as if dotted with the points of as many bristles. I repeated this experiment several times, but with always the same results.

Exp. VIII.—*That Copperas does not combine with Varnish, but only hardens it.*

Three pounds very fine African copal, one gallon of clarified oil, and two ounces of dried copperas, were mixed off with two gallons of turpentine, which, after being strained, had been put by in an open-mouthed jar, for eight months; I then poured off all the varnish, not quite to the bottoms. I afterwards well washed the sediment left at the bottom of the jar with two quarts of warm turpentine, which I filtered through some very fine cambric-muslin, and afterwards dried the copperas in the sun; it still weighed two ounces, and appeared like what it nearly was, powder of zinc.

Exp. IX.—*That Sugar of Lead does combine with Varnish.*

With the same quantity and quality of gum oil and turpentine I made three gallons of copal varnish, introducing two ounces of dried sugar of lead during the boiling. I put it in a jar for eight months. I then poured off all the varnish, and washed out the sediment with half a gallon of warm turpentine, filtered as before. I dried the residuum left on the muslin, which only weighed seven drachms, and appeared of a pearly lead colour, so that the varnish had absorbed the remainder. This varnish was very good, and dried well.

Exp. X.—*That Turpentine improves by Age.*

3 lbs. of fine African gum-copal with one gallon of clarified oil were boiled without any driers, and thinned with two gallons of turpentine which had been kept in an open leaden cistern for upwards of two years, until it had become thickened and appeared like oil. After being mixed off and strained and set to settle only two days, I tried it on several pannels of different colours, when it dried hard, firm, and brilliant, without any tack, in less than eight hours. I kept the remainder of this varnish for twelve months, when it became too thick to use. I poured it into the gum-pot, brought it near to a boiling heat, and poured to it half a gallon of the same old turpentine, and set it aside for two days, when I varnished three fresh pannels of three different colours, which had been previously twice varnished; they all dried firm and free from tack in less than five hours, and had every appearance of fine cabinet varnish. These three pannels were afterwards laid on the roof of a shed for twelve months, and, when polished, looked solid and brilliant, and the colours were less changed than any I ever saw in the same time.

Exp. XI.—*That Varnish improves by Heat.*

Very recently I had a brick erection (two feet high by four feet wide) built all round the warehouse, with an air-furnace at one end, whereby the heat and smoke were conveyed inside a large flue in the brick-work from one end to the other, where it joined into a chimney-shaft. This brick erection was covered with foot-tiles laid in composition, and over the foot-tiles was laid a bed one inch thick of fine sand sifted. Upon this sand were set the varnish-cisterns, four feet by three, and three feet deep, made of inch-and-quarter boards, and lined with lead. When these cisterns were filled up, each held 150 gallons, and a regular fire was kept up in the furnace

every other day. During the time the fire was kept up, the varnish in the cisterns expanded to such a degree, that it rose two inches in the cistern nearest the furnace. During the time of its expansion it gave out a sickly smell of gas, turpentine, and moist air; but as soon as the furnace begins to cool gradually, the acid, moisture, and driers, descend to the bottoms of the cisterns, while the varnish on the surface attracts fresh oxygen from the air of the warehouse; so that, by alternately heating and cooling the varnish in this manner for four months, it acquired all the properties and qualities equal to varnish which has been kept without heat for twelve months. I have repeatedly tried the experiment, and always found it answer.

EXP. XII.—*That all copal or Oil Varnishes require Age before they ought to be used.*

I have frequently filled up several cisterns of varnish, each containing 150 gallons. When they have stood one month, I have varnished a pannel with varnish from the suface of each, when I have found every one of the pannels dry firm in regular time, and have no appearance of pin-holes whatever. On the same day I have taken out fifty gallons of varnish from each cistern. I then, out of the cisterns, which had 100 gallons left in each, varnished a pannel. I found all these dry in the same time as the first, but every pannel was either more or less sleepy or steamy, and appeared as if a fine mist had carried off the glossiness.

After taking out forty gallons more from each cistern, there were only sixty gallons left in each. I then varnished a pannel from each cistern; none of them dried so soon by two hours, and every pannel was opaque and full of pin-holes. I repeated the same experiment from different cisterns of varnish many times, at various periods from the varnishes being made, from one month's age to twelve, and have invariably found that the varnish

within fifteen inches of the surface is more perfect and sooner ready for use than that beneath it, and that the varnish towards the bottom of all cisterns requires time and the action of warm air to cause the moisture, acid, and driers, to settle before the varnish is fit to use.

Concluding Observations.

N.B. All body varnishes are intended and ought to have 1½ lbs. of gum to each gallon of varnish, when the varnish is strained off and cold; but as the thinning up, or quantity of turpentine required to bring it to its proper consistence, depends very much upon the degree of boiling it has undergone, therefore, when the gum and oil have not been strongly boiled, it requires less turpentine to thin it up; whereas, when the gum and oil are very strongly boiled together, a pot of twenty gallons will require perhaps three gallons above the regular proportionate quantity; and if mixing the turpentine is commenced too soon, and the pot not sufficiently cool, there will be frequently above a gallon and a half of turpentine lost by evaporation.

All carriage, wainscot, mahogany, &c., varnish ought to have full one pound of gum for each gallon when strained and cold; and should one pot require more than its proportion of turpentine, the following pot can easily be left not quite so strong boiled, then it will require less turpentine to thin it up.

Gold sizes, whether pale or dark, ought to have full half a pound of good gum to each gallon when it is finished; and best black japan to have half a pound of good gum, or upwards, besides the quantity of asphaltum. The foregoing proportions I have found to answer best in general; but, recollect, if the gum either be of such inferior quality that it will not properly fuse, or if it should, through inexperience or neglect, not be properly fused, however good the quality, the produce will be both inferior and deficient. And I am perfectly convinced,

from forty years' experience, that the greatest and most essential art belonging to the business of varnish-making consists in the management and regulation of the fire in the gum-furnace, so that the gum, from the beginning of its softening in the gum-pot, and during the whole time of its fusion, shall be so managed, according to the nature and quality of that particular sort, particularly in increasing the heat, that it shall carry up and out of the pot all or as much of the gas and acid as is possible, which is the most difficult for an inexperienced person to understand, and indeed, very few think about it.

Every varnish-maker, during the time his furnaces are at work, ought always to have his assistant at hand, whether he is wanted or not; and when any thing is to be done quickly, such as lifting a pot from the fire, pouring, or any thing that requires two persons, never do any thing in a hurry or flutter, but always be cool, collected, and firm; and to insure against accidents, be prepared to meet them deliberately. A nervous or timorous person, is unfit either for a maker or assistant, and the greatest number of accidents occur either through hurry, fear, or drunkenness.

Fine Mastic or Picture Varnish.

Put 5 lbs. of fine picked gum-mastic into a new four-gallon tin bottle; get ready 2 lbs. of glass bruised as small as barley; wash it several times; afterwards dry it perfectly, and put it into the bottle with two gallons of turpentine that has settled some time; put a piece of soft leather under the bung, lay the tin on a sack upon the counter, table, or any thing that stands solid; begin to agitate the tin, smartly rolling it backward and forward, causing the gum, glass, and turpentine, to work like a barrel-churn for at least four hours, when the varnish may be emptied out into any thing sufficiently clean, and large enough to hold it. If the gum is not all dissolved, return the whole into the bottle and agitate as before,

until all the gum is dissolved, then strain it through fine thin muslin into a clean tin bottle; leave it uncorked, so that the air can get in, but no dust; let it stand for nine months at least before it is used, for the longer it is kept the tougher it will be, and less liable to chill or bloom. To prevent mastic-varnish from chilling, boil a quart of river-sand with 2 ounces of pearl-ashes, afterwards wash the sand three or four times with hot water, straining it each time; put the sand on a soup-plate to dry in an oven, and when it is of a good heat, pour half a pint of hot sand into each gallon of varnish, and shake it well for five minutes; it will soon settle and carry down the moisture of the gum and turpentine, which is the general cause of mastic-varnish chilling on paintings.

Common Mastic-Varnish.

Put as much gum-mastic, unpicked, into the gum-pot as may be required, and to every 2½ lbs. of gum pour in one gallon of cold turpentine; set the pot over a very moderate fire, and stir it with the stirrer; be careful, when the steam of the turpentine rises near the mouth of the pot, to cover it with the carpet, and carry it out of doors, as the least steam will catch fire: a few minutes low heat will perfectly dissolve 8 lbs. of gum, which will, with four gallons of turpentine, produce, when strained, four and a half gallons of varnish, to which add, while yet hot, five pints of pale turpentine varnish, which improves the body and hardness of the mastic-varnish.

Another cheap Varnish for Paper-hangings.

Put into the gum-pot 10 lbs. of gum cat's-eye, with four gallons of turpentine, and at a low heat dissolve it like the mastic; then strain it into a cistern or tin. After having washed out the gum-pot and wiped it clean, dissolve 5 lbs. of unpicked gum-mastic in two gallons of turpentine, and strain it warm into the cat's-eye varnish. After washing and wiping out the gum-pot as before,

dissolve 10 lbs. of good white frankincense with four gallons of turpentine; strain it, and, while hot, mix this to the two former products; stir them together, take a little out in a saucer, and if too thick, thin it with turpentine until of a proper consistence: when boiled, it may be used, but it is better for age. This may be made excellent at the cost of 10*s*. per gallon.

Crystal Varnish

May be made either in the varnish-house, drawing-room, or parlour. Procure a bottle of Canada balsam, which can be had at any druggist's; draw out the cork, and set the bottle of balsam at a little distance from the fire, turning it round several times until the heat has thinned it; then have something that will hold as much as double the quantity of balsam, carry the balsam from the fire, and, while fluid, mix it with the same quantity of good turpentine, and shake them together, until they are well incorporated: in a few days the varnish is fit for use, particularly if it is poured into a half-gallon glass or stone-bottle, and kept in a gentle warmth. This varnish is used for maps, prints, charts, drawings, paper ornaments, &c.; and when required to be made upon a larger scale, requires only warming the balsam to mix with the turpentine.

White hard Spirit-of-wine Varnish.

Put 5 lbs. of gum sandarach into a four-gallon tin bottle, with two gallons of spirits of wine, 60 over proof, and agitate it until dissolved, exactly as directed for the best mastic-varnish, recollecting, if washed glass is used, that it is convenient to dip the bottle containing the gum and spirits into a copperful of hot water every ten minutes, the bottle to be immersed only two minutes at a time, it will greatly assist the dissolving of the gum; but, above all, be careful to keep a firm hold over the cork of the bottle, otherwise the rarefaction will drive the cork

out with the force of a shot, and perhaps set fire to the place. The bottle, every time it is heated, ought to be carried away from the fire, then ease the cork a little, to allow the rarefied air to escape, then drive it tight, and continue the agitation in this manner until all the gum is properly dissolved, which is easily known by having an empty tin can to pour the varnish into, until near the last, which pour into a gallon measure; and if the gum is not all dissolved, return the whole into the four-gallon tin, and continue the agitation until it is ready to be strained, when every thing ought to be quite ready, and perfectly clean and dry, as oily tins, funnels, strainers, or any thing damp, or even cold weather, will chill and spoil the varnish. After it is strained off, put into the varnish one quart of very pale turpentine varnish, and shake and mix the two well together. Keep spirit-varnishes well corked: they are fit to use the day after being made.

Brown hard Spirit-Varnish

Is made by putting into a bottle 3 lbs. of gum sandarach with 2 lbs. of shell-lac, and two gallons of spirits of wine, 60 over proof; proceed exactly as before directed for the white hard varnish, or by agitating it when cold, which requires about four hours' time, without any danger of fire; whereas making any spirit-varnish by heat is always attended with danger. No spirit-varnish ought to be made either near a fire or by candle-light. When the brown hard is strained, add one quart of turpentine varnish, and shake and mix it well; next day it is fit for use.

Gold Lacker.

Put into a clean four-gallon tin, 1 lb. of ground turmeric, 1½ ounce of powdered gamboge, 3½ lbs. powdered gum sandarach, ¾ lb. of shell-lac, and 2 gallons of spirits of wine. After being agitated, dissolved, and strained, add one pint of turpentine varnish, well mixed.

Red Spirit Lacker.

2 gallons of spirits of wine,
1 lb. of dragon's blood,
3 lbs. of Spanish annato,
3½ lbs. gum sandarach,
2 pints of turpentine.

Made exactly as the yellow gold lacker.

Pale Brass Lacker.

2 gallons of spirits of wine,
3 ounces of Cape aloes, cut small,
1 lb. of fine pale shell-lac,
1 ounce gamboge, cut small,
No turpentine varnish.

Made exactly as before; but observe, that those who make lackers frequently want some pale and some darker, and sometimes inclining more to the particular tint of some of the component ingredients. Therefore, if a four-ounce vial of a strong solution of each ingredient be prepared, there can be at any time produced a lacker of any tint required.

Having so far given plain and particular directions, it will be very easy for the operator to modify, or make any intermediate proportion or alteration, according to his judgment or inclination.

PROGRESS OF SCIENCE

APPLIED TO THE ARTS AND MANUFACTURES, TO COMMERCE, AND TO AGRICULTURE.

New Concave Achromatic Lens, adapted to the Wired Micrometer. By Mr. Dollond.—A paper was read before the Royal Society, on the 27th of February last, entitled "An Account of a Concave Achromatic Lens, adapted to the Wired Micrometer, which has been named *Macro-micro,* from its power to increase the primary image of a Telescope without increasing the diameter of the wires in

the Micrometer." By George Dollond, Esq., F.R.S. Of this paper the following is the official abstract, as printed in the *Proceedings of the Royal Society*.

The application of a concave achromatic lens to the wired micrometer of a telescope, arose out of the series of trials that were made for the purpose of correcting the aberrations of the eye-glasses applied to the telescope constructed by the author for the Royal Society, with a fluid-correcting lens, on the plan suggested by Professor Barlow. The concave lens, being interposed between the object-glass and the eye-glass, and being at the same time achromatic, combines the advantages of doubling the magnifying power, without a corresponding diminution of light, and without altering the apparent distances of the threads of the micrometer. The results of the trials made with telescopes to which this addition was made, are given in a letter to the author from the Rev. W. R. Dawes, of Ormskirk; from which it appears that Mr. Dollond's method was attended with complete success. Mr. Dawes states, that, in order to put its illuminating power to a severe test, he had examined with this instrument the satellites of Saturn and the minute companion of κ Geminorum, but could discover no decided difference in the apparent brightness of the former, allowance being made for the difference in the power employed; and the latter star was seen quite as distinctly with a much smaller power.

Extracts are subjoined from a letter of Professor Barlow's to the author, containing formulæ for the construction of the lens.

On the Berlin Cast-Iron Ornaments. By Dr. Friedenberg.—In the Edinburgh New Philosophical Journal for April, 1834, we find the following translation of an account of the celebrated cast-iron ornaments manufactured at Berlin, which has been given by Dr. Friedenberg in his German edition of Mr. Babbage's work on the Economy of Machinery and Manufactures.

The Berlin cast-iron ornaments may be mentioned as an interesting example of the increased value of manufactured, in comparison with the raw material; and we select this manufacture the more willingly, as it had its origin in Prussia; and though many attempts at imitation have been made, has never yet been equalled by any other country. In one of the principal manufactories of this description in Berlin, that of Devaranne, such is the fineness and delicacy of those separate arabesques, rosettes, medallions, &c. of which the larger ornaments are composed, that nearly ten thousand go to the pound. The price increases in proportion to the fineness, as will be seen by the following table, which gives the selling prices of the abovenamed manufacturer.

	No. to the cwt.	Price of each article.	Price per cwt. of the same.
		£. s. d.	£. s. d.
1. Buckles, $3\frac{1}{2}$ inches long, and $2\frac{1}{2}$ inches broad............	2640	0 2 6	330 0 0
2. Neck chains, 18 inches long, and 1 inch broad; and composed of 40 separate pieces..	2310	0 6 0	693 0 0
3. Bracelets, 7 inches long, and 2 inches broad; and composed of 72 pieces	2090 pair	0 8 6	888 5 0
4. Diadems, $7\frac{1}{2}$ inches high, and $5\frac{1}{4}$ inches broad.............	1100	0 16 6	907 10 0
5. *Sevigné needles*, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inches broad; and composed of 11 parts..........	9020	0 4 6	202 10 0
6. Sevigné ear-rings, 3 inches long, and $\frac{7}{8}$ of an inch broad; composed of 24 pieces......	10,450 pair	0 5 3	2743 2 6
7. Shirt buttons	88,440	0 0 8	2948 0 0

If we reckon the price of the grey iron, from which these ornaments are made, at 6s. per cwt. on an average, we find that the value of the material is increased 1100 *times* in the *coarser* articles, and 9827 *times* in the *finest*.

The above are the retail prices, and the wholesale prices are probably one-sixth or one-eighth less: but we must remark that, compared with the old prices, the present ones are much fallen. About six years ago they were twice as high, and twelve years ago three times; so that at that time Berlin cast-iron was nearly of equal value with gold, — a remarkable example, and perhaps one of the strongest proofs of the influence of the industry of manufacturers on the wealth of the state, especially when we consider that the cast-iron ornaments are made of native material, and exported in large quantities abroad, and even indeed to America. It is so much the more to be regretted, that, owing to the imitation system which already prevails to a great extent, a branch of native industry, once so flourishing, should threaten to fall gradually into decay. The facility of imitation of the most saleable objects, by purchasing them at a low price, using them as models, and then casting articles of the same description, enables the imitator to offer his goods at such a low price, that the industrious original manufacturer, who has been at the expense of much time and capital in the designing and forming a brass model, finds it impossible to enter into competition with him. On the one hand, therefore, the manufacturer cannot venture to expend much capital on new models which do not repay the outlay, and, on the other, by repeated cast-

ing, the articles lose much of their sharpness and beauty, and the natural consequence (and which is already perceptible) is, that their reputation abroad must sink; and, notwithstanding their moderate prices, the sale must decline. On this account some of the best manufacturers have given up the business, and the task of improving and perfecting this branch of industry now rests in the hands of a few.

The piracy of locks is regarded as dishonourable, and against the laws; in technical manufactures new discoveries and improvements can be secured by patents; the cast-iron manufacture alone is unprotected, and imitation allowed to be carried on openly and freely.*

Mr. Palmer on the Motions of Shingle Beaches.—On the 10th of April a paper was read before the Royal Society, entitled, "Observations on the Motions of Shingle Beaches," by Henry R. Palmer, Esq., F.R.S.; of which the following is the official report, from the "Proceedings" of the Society.

The author states that the object of his inquiries is limited to the collection of such facts as may assist in establishing practical rules for controlling the motions of the beach, with a view, on the one hand, to the preservation of clear channels where such are wanted, and on the other, to the obtaining accumulations of shingles in situations where they may be useful. He considers the actions of the sea on the loose pebbles as of three kinds, the first, which he terms the *accumulative action*, heaps up or accumulates the pebbles against the shore; the second, or the *destructive action*, disturbs and breaks down the accumulations previously made; and the third, or *progressive action*, carries the pebbles forwards in a horizontal direction. The causes of these actions are referable to two kinds of forces; the one being that of the current, or the motion of the general body of the water in the ebbing and flowing of the tides; and the other that of the waves, or that undulating motion given to the water by the action of the winds upon it.

He adduces many facts which show that it is not, as is generally believed, the currents which move the pebbles along the coast, the real agent being the force of the waves, the direction of which is determined principally by that of the prevailing winds, which, on the coasts of Kent and Sussex, where the author's observations were chiefly made, is from the westward. Every breaker drives before it the loose

* We may remark here, that many British manufactures in which patterns of various kinds are employed require the protection of the British legislature as greatly as the cast-iron ornaments of Berlin are stated to need that of the Prussian government. If we remember right, the manufacture of brass ornaments of every description at Birmingham may be cited as an example, to which we believe calico-printing may be added.—A. T.

materials which it meets, throwing them up on the inclined plane on which they rest, and in a direction corresponding generally with that of the breaker. In all cases, the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstice; but the larger pebbles return only a part of the distance, this distance having an inverse ratio to its magnitude. This process constitutes the accumulative action. Under other circumstances, on the contrary, depending on the quickness of succession of the breakers, pebbles of every dimension return the whole distance along which they had been carried up, and are also accompanied in their recession by other pebbles which had been previously deposited; and this constitutes the destructive action. This latter action is also promoted by a form of coast, such as that produced by rocks, tending to confine the returning waves in particular channels, whereby, being collected into streams instead of being broken and dispersed, they acquire, on the recoil, sufficient force to carry down the pebbles, and deposit them below the general surface. The author gives examples of these effects, from what he has observed in the neighbourhood of the harbours of Folkstone, Dover, and Sandgate, and along the coast as far as the bay called Sandwich Flats; accompanied by illustrative drawings.

On these principles, the author thinks it will readily appear why the various attempts hitherto made to divert the motion of the shingles to a distance from the general line of the shore, both at Dover and at Folkstone, have invariably failed; and he recommends, for the prevention of the evil of accumulation, the adoption of a more general system of management along the coast, in preference to the resorting to particular devices adapted exclusively to each particular case.

A report of a lecture on the same subject delivered by Mr. Palmer at the Royal Institution, will be found in the *Repertory*, Third Series, vol. xvi., p. 42, in the number for July, 1833.

ACCOUNTS OF THE MEANS EMPLOYED FOR THE RECOVERY OF TREASURE, STORES, AND OTHER PROPERTY, FROM THE WRECK OF THE THETIS. BY COMMANDER DE ROOS, R.N., AND COMMANDER DICKINSON, R.N.—The following are abstracts, from the *Proceedings of the Royal Society*, of two papers on the recovery of treasure and stores from the wreck of the Thetis, which were read before that learned body, on the 20th and 27th of February and 20th of March last.

Abstract of "An Account of some Operations executed at Cape Frio, by the Officers and Crew of His Majesty's Ship Algerine, for the purpose of raising a part of the Stores, &c. lost in His Majesty's Ship Thetis. By the Hon. Commander F. T. de Roos, R.N., F.R.S."

The author, who had the command of His Majesty's ship Algerine,

was instructed to take charge of the enterprise commenced by the officers and crew of His Majesty's ship Lightning, having for its object the recovery of the treasure and stores from the wreck of the Thetis, which, in the month of December, 1830, had sunk in a cove to the south-east of Cape Frio. He reached this spot on the 6th of March, 1832, having with him eleven officers, and eighty-five men. A certain number of men were appointed to remain on board the ship, which was moored in a harbour two miles off, a party of artificers and others were employed at the huts which they inhabited near the Cape; and the rest, nearly thirty-five in number, were stationed at the wreck.

The author gives a description of Cape Frio, and of the island of which it forms the south-eastern extremity, and which is an immense promontory of insulated granite jutting into the Atlantic Ocean, sixty miles east of Rio de Janeiro. The cove, in the middle of which the wreck of the Thetis lay, is a square indenture in the cliffs, six hundred feet deep by as many wide. It is surrounded by nearly perpendicular masses of granite, from one hundred to two hundred feet high, and is exposed to the whole swell of the South Atlantic, which sets in with remarkable force in that direction. The weather is singularly variable; and transitions frequently take place in the course of a few hours, from perfect stillness to the most tremendous swell. The author states that he has witnessed few scenes in nature more sublime than that presented by the Thetis Cove during a gale of wind from the south-west.

The author enters into a minute description of the mechanical apparatus employed for obtaining the necessary purchases for the various operations which were required, and gives a circumstantial history of his proceedings. Frequent interruptions were experienced from the state of the weather, and the almost incessant agitation of the water, which was often so powerful as to render the diving bell unmanageable, and to expose the divers to serious danger. The diving bell consisted of a one-ton ship's water-tank, with eight inches of iron rivetted to the bottom in order to give it more depth, and having attached to it eighteen pigs of ballast, the weight of which (17 cwt.) was found to be sufficient to sink it.

As soon as the necessary arrangements had been completed, the author states that he made a minute survey of the bottom, by means of the diving-bell, and ascertained the exact position and shape of all the large rocks which covered the spot where the treasures and stores of the Thetis had been scattered. The shape of the area where the precious metals in particular had been deposited, was an ellipse, of which the two principal axes measured forty-eight and thirty-one feet; and large boulders of granite had been subsequently rolled over these

treasures, and required being removed before the latter could be recovered. The superincumbent pressure of the sea, aided by the huge materials of the wreck of the frigate, which, under the influence of the swell, acting like a paviour's hammer, with enormous momentum, had jammed together the rocks, and produced a strong cohesion between the fragments of wood, and the gold, silver, and iron.

The first object was to clear away every portion of the wreck; and after this had been accomplished, to loosen and remove all the large rocks in succession, beginning with the smallest, and ending with the largest and most unweildy. Some of these, which they succeeded in rolling from their situations into deeper water, weighed about thirty or forty tons; and the largest, which required the greatest efforts to move from its place, was computed to weigh sixty-three tons. This last effort served to show, that no part, either of the wreck or the stores, which was of any value, remained behind; and after fifteen-sixteenths of the property had been recovered, the enterprise, which had so perfectly succeeded, terminated on the 24th of July, and the Algerine returned to Rio de Janeiro on the 1st of August.

The author subjoins an account of the currents off Cape Frio, and a description of the climate, which seems to have been favourable, for his party suffered but little from sickness, and the expedition was unattended with the loss of a single life. On one occcasion the party were visited by a whale, which approached very near the diving-bell, but fortunately changed its course without doing any mischief.

Abstract of a paper entitled, "Narrative of the Proceedings of Commander Thomas Dickinson, of His Majesty's Sloop Lightning, while employed in the enterprise for the recovery of the Public Stores and other Property sunk in His Majesty's late Frigate Thetis, on the south-west side of the Island of Cape Frio." By Commander Thomas Dickinson, R. N. Communicated by P. M. Roget, M. D., and J. G. Children, Esq., Secretaries to the Royal Society. It was preceded by the reading of a letter from the author to the Secretary, explaining the reasons which induced him to lay this narrative before the Royal Society, and place on the records of its proceedings the information it contains relative to the commencement of an enterprise, wholly planned and undertaken by himself, and which, under his superintendence, was, by the great, persevering, and meritorious exertions of his officers and crew, most successfully accomplished.

The narrative commences with the statement of the consternation produced at Rio de Janeiro on the receipt of the intelligence of the loss of the Thetis, with a freight of about 810,000 dollars, on the south-west side of the Island of Cape Frio, and of the determination of the author, on finding that no one seemed disposed to take any

step towards the recovery of the property thus lost, to make the attempt himself, if he could obtain from the Commander-in-chief at that station, Rear Admiral Thomas Baker, C. B., orders to that effect. He accordingly exerted himself to obtain every possible information relative to the nature of the coast, depth of water, and other circumstances, which might enable him to judge of the practicability of the undertaking, and of the means necessary for its successful accomplishment; and became convinced that the difficulties and obstacles to be encountered, although numerous and formidable, might be overcome by the employment of the means which suggested themselves to him as practicable on this occasion, if sufficient assistance were afforded him in putting them into execution. He accordingly had models of the proposed machinery made, and submitted them, together with his plans, to the Commander-in-chief, by whom they were approved. He experienced great difficulties in procuring a suitable diving-bell, for it was impossible to obtain any instrument of the kind at Rio de Janeiro, or even any facilities for the construction of one by casting. It at length occurred to him that a ship's iron water-tank might be converted to this use; and being supplied with one from the Warspite, he was enabled to render it available for that purpose. The next difficulty was to procure an air-pump, which, after much delay, owing to the tardiness of the native workmen in that country, was at length constructed. The want of air-hoses, however, was a still more formidable obstacle to the success of the plan; but the ingenious contrivances of the author for rendering the common pump hoses air-tight, supplied this deficiency; and on a trial which he made with the whole apparatus on the 22nd of January, 1831, it was found to answer completely. The next day he received his orders from the Commander-in-chief, and, sailing on the following day, arrived at the harbour of Cape Frio on the 30th, and immediately proceeded to inspect the coast, and ascertain the situation of the wreck, not a vestige of which was visible. An account is then given of the local circumstances of the Thetis cove, or inlet, surrounded by almost perpendicular cliffs, from 108 to 194 feet in height, with a depth of water varying from 3½ to 24 fathoms, and the bottom being strewed with huge perpendicular rocks, occasioning these inequalities. These surveys shewed that the execution of the plan originally conceived by the author was opposed by so many unforeseen difficulties, that he was obliged to relinquish some part of it, and resort to fresh expedients for surmounting them. The idea of constructing a derrick then occurred to him, but the materials were wanting, for no trees existed in the island except those in the forests in the interior, which were inaccessible from their distance and the heights on which they grew, and of which the wood was, from its quality, unsuitable to the purpose.

His only resource, therefore, was to make it of the fragments of spars saved from the wreck. With great exertions, a circumstantial account of which is given in the paper, the work was at length accomplished; and the result fully equalled the anticipations which had been formed of its utility in affording a stable point of support for the operations with the diving-bell. Previously to the erection of a derrick, however, much had been done by working the diving-bell from a boat, and a considerable quantity of stores and treasure raised. At one time the anxiety of the author to forward the undertaking, and avail himself of favourable weather, induced him to try the experiment of working by torch-light, which succeeded to a certain extent; but after a few trials the danger was found to be excessive, and the fatigue to the divers so great as to oblige him to desist.

After the derrick had been for some time in operation, a tremendous sea arose, the shock of which, for want of sufficient materials to support it, effected its destruction; and a substitute was then resorted to by the setting up of a suspension cable diagonally from the cliffs, which, after great difficulties, was at length effected.

A great portion of the narrative is occupied with the details of the various proceedings, and of the serious impediments which were successively overcome by the zeal, perseverance, and extraordinary exertions of the officers and crew, under the orders of Captain Dickinson, subjected as they were, for so long a period, to the greatest privations and hardships, arising from the laborious nature of the work, the unhealthiness of the climate, the attacks of the chigger (producing distressing ulcers in the feet), the annoyance from drifting sand, which penetrated into every place, the exposure to constant wet in huts which could not be made to exclude either wind or rain, and the perils arising from the boisterous gales and tremendous swell of the sea, which the whole ship's company, but more particularly the men in the diving-bell, had to encounter; forming a combination of difficulties which the author is convinced could have been surmounted by none but British seamen.

After having succeeded so far in the undertaking, and made, at various times, shipments for England of treasure amounting to about three-fourths of the whole which had been on board the Thetis when she sunk, orders were received by the author, on the 6th of March, to resign the charge of the enterprise to the Honourable Captain De Roos, of His Majesty's brig Algerine; on the receipt of which he immediately ordered a survey to be taken of the stores, and on the 9th descended in the bell, surveyed the bottom of the Cove, ascertained the position of the remaining stores, and a considerable quantity of treasure; and after having communicated the whole of the results to Captain De Roos, instructed him, his officers and ship's company in the way

of working the bell, as well as in the different modes of removing rocks, recovering stores and treasure, and the use of the whole of the machinery, and furnished him with every necessary information for his guidance; he lent twenty of his men to the Algerine for their assistance, resigned the charge to his direction on the 10th, and sailed for Rio de Janeiro on the 13th.

Annexed to the paper is a journal of the amount of treasure of various descriptions recovered between the 31st of March, 1831, and the 10th of March, 1832, by His Majesty sloop Lightning.

There was then read an extract of the letter of instructions, bearing date the 10th of March, 1832, from Commander Thomas Dickinson, then of His Majesty's ship Lightning, to Commander the Honourable S. F. De Roos, then of His Majesty's brig Algerine, on the former resigning to the latter the charge and direction of the enterprise for the recovery of the public stores and treasures sunk in His Majesty's late frigate Thetis, off Cape Frio.

On the Plant which yields the Cascarilla Bark. By David Don, Esq., Libr. L. S., &c. — There is reason to believe that many species of *Croton* afford a bark partaking more or less of the properties of Cascarilla, and indeed this opinion is borne out by analogy with other genera among whose members similar qualities are generally found to prevail. It is a curious fact, however, that the *Croton Cascarilla* of Linnæus possesses none of the sensible properties of cascarilla bark. The late Dr. Wright, whose knowledge of the medicinal plants of Jamaica was unrivalled, appears to have been the first to determine this fact, and that the bark in question was derived from the *Croton Eluteria*, of which a faithful representation will be found in Sloane's Jamaica (vol. ii. t. 174, f. 2.), referred incorrectly by Linnæus to his *Croton glabellum*. The same opinion seems also to have been entertained by Linnæus himself, for in the first edition of his *Materia Medica*, the *Cascarilla cortex* is mentioned as one of the products of *Clutia Eluteria*, but he afterwards, as now appears, on very insufficient grounds, altered his opinion in favour of a plant with which he was entirely unacquainted, except from the figure in Catesby's Carolina (vol. ii. t. 46). Of this plant, which he named *Clutia Cascarilla*, he had then seen no specimen, and in the Species Plantarum, where it occurs for the first time, he has stamped it with the usual mark of an obscure species. Of *Clutia Eluteria* he had a sample, from which he evidently drew up his description in the *Amœnitates Academicæ*, although he confounded with it a Ceylonese plant, which he had taken up in the *Flora Zeylanica*, from Hermann, and likewise two other totally different species, the first figured by Plukenet, which is *Croton micans* of Swartz, and the second by Seba (Thesaurus, vol. i. t. 35, f. 3). In the Lambertian Herbarium, there is a specimen from Curaçao, exactly

resembling the last-mentioned figure, which I should be inclined to refer to the *Croton nitens* of Swartz. The specific character, which occurs throughout all Linnæus' works, of *Clatia*, or rather *Croton Eluteria*, appears to refer entirely to the Ceylon plant, whose history is still involved in great obscurity.

Dr. Wright considered the Eleutheria and Cascarilla barks as the produce of *Croton Eluteria*, and this opinion is now pretty generally adopted by pharmaceutical writers; but I am disposed to regard them as derived from two distinct species, and I rather incline to the opinion of Boulduc, Spielmann, and others, that the cascarilla bark is a production of the Spanish main, for it does not appear that it ever was obtained from Jamaica, or even from the Bahama Islands (from one of which the appellation Eluteria or Eleutheria is derived); and it is now ascertained, from the recent observations of Messieurs Schiede and Deppe, that a bark, agreeing in every particular with the cascarilla bark of the shops, is collected extensively in the vicinity of Jalapa, at Actopan, and in the district of Plandel Rio, in the province of Vera Cruz, Mexico, where it is known by the names of Copalche or Quina Blanca. These gentlemen considered the plant at the time to be identical with the *Croton Eluteria*, but although closely related, it is nevertheless essentially distinct from that species, differing in its broadly cordate five-nerved leaves, which are slightly peltate at their insertion, and of a more coriaceous texture. In *Croton Eluteria* the leaves are ovate-oblong or elliptical, furnished with a solitary midrib, having obliquely transverse ramifications, and the base either obtuse or somewhat attenuated, but neither cordate nor peltate. The inflorescence is racemose, and in other respects nearly similar in both species. The tree grows to the height of 25 or 30 feet, is much branched, and clothed with a profusion of broadly cordate leaves, silvery underneath, and numerous clusters of white flowers. The bark is exteriorly of a gray colour, pale brown within, of an even fracture, possessing strong aromatic flavour, and an agreeable bitter taste, and in other respects accords with the Cascarilla bark of the shops, for I have carefully compared samples of the bark sent by Messieurs Schiede and Deppe, with others from the Apothecaries' Hall, and I think there cannot be a question as to their identity. To the Mexican species I would recommend the application of the name of *Croton Cascarilla*, that of *Pseudo-China*, given to it by Professor Schlechtendal, in his recent treatise on the subject, being in many respects objectionable, and leaving to the *Croton Cascarilla* of Linnæus the more recent epithet of *linearis* applied to it by Jacquin, being perfectly convinced of the identity of the latter with the Linnean *Cascarilla*, and that the distinctions hitherto relied on to keep them apart are of too trivial and variable a nature to be entitled to the importance which has been assigned them. The

specimen in the Linnean Herbarium appears to have been communicated by Philip Miller, and belongs to the West India variety, with narrower leaves, and consequently is what Jacquin meant by his *Croton linearis.* The glands at the insertion of the leaf, I observe, vary from two to four, although, in the specific character of *linearis,* they are stated to be uniformly two, and three in *Croton Cascarilla.*—*Edin. New Phil. Journ. April,* 1834.

On Kreosote the anti-putrescent principle of Pyroligneous Acid and of Wood Smoke. By M. Reichenbach, of Blansko.—M. Reichenbach, of Blansko, to whose labours we owe the discovery of Paraffine, of Eupione*, and Picamore, has recently found in the products of the destructive distillation of wood, a new substance, which he terms Kreosote, from the Greek words κρεας *flesh,* genitive by contraction κρεως, and σώζω *I save.*

This substance is highly interesting, not only on account of its chemical properties, but from its useful application to therapeutics, domestic economy, and the preservation of provisions for long voyages. Two processes are given for its preparation. By the one, the Kreosote is obtained from pyroligneous acid, by the other, from the tarry matter which distils over along with that acid. These processes do not differ much; both are tedious, but the latter method seems to be the easier. The tarry matter yields an oil by distillation, to which, after being rectified and heated, carbonate of potash is added, to neutralize the acetic acid associated with it. The acetate of potash separates, and the oil is again distilled, care being taken to reject the first products, and not to carry the distillation to dryness. The oil that comes over is then treated with a solution of caustic potash of sp. gr. 1.12, great heat is produced, and a portion of eupione, &c., formed, which floats on the surface. These are rejected, and the alkaline solution is slowly made to boil in an open vessel. A chemical action takes place, —it absorbs oxygen from the air, and assumes a brown colour. After it is cooled in the open air, diluted sulphuric acid is added until the oil is set free. It is again distilled with water, to which a little caustic potash should be added. The oil is then separated from the water in the receiver, and again treated with a solution of potash, sp. gr. 1.12, boiled as before—cooled—treated with rather an excess of sulphuric acid—poured off from the sulphate of potash—well washed with water to carry off the excess of acid—again distilled with water, to which a little phosphoric acid is added, to saturate the ammonia associated with the oil. Lastly, it is dissolved in caustic potash; and if the preceding operations have been carefully attended to, the kreosote and the

* An account of these substances will be found in the *Repertory,* third series, vol. xv., p. 34, in the number for January, 1833.

potash unite, and the mixture, when heated, leaves no residuum of eupione, nor becomes brown by exposure to the air. The kreosote may then be separated from the potash by distillation, and, although not quite pure, is sufficiently so for medical purposes. The foregoing is a very imperfect outline of the process, which will be seen to be sufficiently tedious. The processes will be found minutely described in the Annals [für Chimie, &c.] of Schweigger-Seidel, vol. vi. and vii.

Kreosote is an oily, colourless, transparent liquid, possessing great refrangibility. Its odour is penetrating, disagreeable, and similar to to that of smoked beef. It is of the consistence of oil of almonds, and has a sp. gr. of about 1.037 at 20° Cels. (68° Fahr.) It boils at 203° Cels. (397.4° Fahr.) and is not congealed at a temperature of — 27° Cels. (—16.6° Fahr.) It burns with a smoky flame. It is a non-conductor of electricity. At 20° Cels. (68° Fahr.) it forms with water two different combinations, the one containing one-fourth part of kreosote in 100 parts of water, the other, ten parts of water in 100 kreosote.

This substance forms numerous interesting compounds with acids and alkalies. Concentrated, it dissolves the deutoxide of copper, and assumes a chocolate brown colour. At a boiling heat it reduces the deutoxide of mercury, and is then transformed into a resin, which has no longer the properties of kreosote. Nitric acid acts on it strongly, and acid vapour are disengaged. It combines with chlorine, bromine, iodine, phosphorus, and sulphur. Potassium thrown into it disappears, gas is disengaged, and potash remains combined with thickened kreosote. From this combination the kreosote separates by distillation. Concentrated sulphuric acid added in small quantities, gives to kreosote a reddish colour; but when the quantity of acid is increased, the kreosote becomes black. Of all the organic acids, the acetic seems to have the greatest affinity for kreosote, uniting with it in every proportion.

This substance, when cold, forms two combinations with potash. The one is an anhydrous liquid, of an oily consistence; the other is a hydrate, and crystallizes in white scales. All the acids, not excepting carbonic acid, separate the kreosote from these combinations. With soda it forms combinations similar to those with potash. It has a great affinity for lime and the hydrate of barytes; with these bodies it forms compounds of a dirty-white colour, soluble in water, but which, when dried, assume the appearance of a rose-coloured powder.

Kreosote, in a warm and cold state, dissolves a great number of salts; some are reduced, but the greater part are separated in the form of crystals by cooling, such as the acetates of potash, soda, ammonia, lead, and zinc, and the hydrochlorates of lime and tin. It reduces the acetate and nitrate of silver.

Alcohol, ether, acetic ether, carburet of sulphur, eupione, and oil

of petroleum, combine with kreosote in every proportion. Paraffine though issuing from the same source with kreosite, has little tendency to combine with it. Indeed, the combination cannot be effected, unless eupione be present, and is in a direct ratio to the quantity of eupione. Kreosote with difficulty dissolves caoutchouc, and only by the assistance of boiling, differing very much in this respect from eupione, which readily dissolves caoutchouc.

If to a solution of albumen in a large quantity of water, a single drop of kreosote be added, the albumen is immediately coagulated. When fresh meat is put into a solution of kreosote, allowed to remain for half an hour or an hour, then withdrawn, and afterwards dried, it may be exposed to the heat of the sun without putrefying, and in the space of eight days it becomes hard, the colour changes to a reddish brown, and the flavour is that of good smoked beef. Fish may likewise be preserved by it. It is pretty evident that kreosote is the antiputrescent principle of pyroligneous acid and of wood smoke.

M. Reichenbach has ascertained that kreosote does not act upon pure fibrin, which by itself is said not to be susceptible of putrefaction. Its action upon the animal economy is deleterious. Placed upon the tongue it occasions violent pain, and when poured in a concentrated state upon the skin, it destroys the epidermis. Insects and fish thrown into it immediately die. Plants also perish when watered with it. M. Reichenbach has made experiments with this substance concentrated and diluted, and his success has surpassed his expectations. It has, he alleges, effected a speedy cure in cases of caries, of cancer, and of carcinomatous ulcers.

M. Schweigger-Seidel has made a comparative examination of kreosote, and the aqua Binelli, from which he has come to the conclusion, that the fundamental base of this hemostatic liquor, is kreosote, of which it is only an excessively weak solution.—*Edin. Med. and Surg. Journ.*

On a new Law of Combustion, applicable to the explanation of the spontaneous combustion of Coal, Cotton, Wool, &c. By Charles J. B. Williams, M.D.—The following is an abstract of Dr. Williams's paper on this subject read before the Royal Society on the 1st of May

The principal object of this paper is to prove that most combustible bodies undergo a kind of combustion, attended with light and heat, at a temperature considerably below that usually assigned as their point of ignition. This fact has been already noticed with regard to phosphorus and sulphur; and the pale blue flame produced in the vapour of ether by a hot palladium or platina wire, before the wire itself becomes vividly ignited, is another instance of the same general law, which the author finds applicable to all compound, and a few of

the simple inflammable bodies. Of these he gives a variety of examples among oleaginous, resinous, and carbonaceous products, both animal and vegetable, which, when thrown on a hot iron, exhibit a pale and faintly luminous flame. Those on the other hand which are very volatile, such as camphor, the essential oils, ether, and alcohol, rise in vapour before they reach the temperature necessary for their combustion; but they may be made to exhibit the same phænomena, by directing their vapour against a body heated below redness. The contact of pure oxygen gas immediately heightens the intensity of the light and heat evolved on these occasions, and excites them into a more decided and vivid combustion.

The author next adverts to the nature of the products of this low form of combustion, which in organic substances, appear to him to form an intermediate link between those of open combustion, and those of fermentation and putrefaction. He considers the phænomena he has described as confirming the truth of a law he formerly announced, namely, that "the evolution of heat during chemical change is, *cæteris paribus*, proportionate to the degree of change from isolation, or weak combination, towards firm and simple union." He thinks they will afford an explanation of many cases of spontaneous combustion, which have hitherto been involved in mystery; such as that of porous combustible matters, as oily cotton, tow, or wool, when accumulated in considerable quantities, in places protected from cooling, or where air has limited access; and also of heaps of coal or charcoal*, of pyrophori and pyrites; and the same principles may perhaps also account for the phænomena of the spontaneous combustion of the human body which are on record.—*Proceedings of the Royal Society.*

Dr. Bostock's Report on the Salubrity of the Waters of the rivers Wandle and Verulam, from which Mr. Telford proposes to derive a supply of pure water for the Metropolis.—Mr. Telford's Report to the Lords of the Treasury "on the Means of supplying the Metropolis with pure water," ordered to be printed by the House of Commons, has just been circulated among the members. Mr. Telford proposes to supply three of the Water Companies on the north side of the Thames with pure water taken from the river Verulam, about two miles above Watford in Hertfordshire; and the three Companies on the south side of the Thames with pure water taken from the Croydon branch of the river Wandle, at Beddington Park, in Surrey. The Appendix to this report

* Papers relative to the causes of the spontaneous combustion of charcoal will be found in the *Repertory*, Third Series, vol. xvi. pp. 153, 158, in the number for September, 1833, and in the present volume, p. 26, number for January, 1834.

contains the results of Dr. Bostock's chemical examination of the water from each of these sources, which we now extract, annexing to them the substance of other communications relative to the salubrity of these and other waters which are also given in the Appendix.

I have examined, Dr. Bostock states, the two specimens of water marked B (from the river Wandle), and C (from the river Verulam): by way of comparison, I made a corresponding set of experiments on the water of the New River.

The water marked B, I found, both in its sensible properties and in its chemical relations, to be of considerable purity. It was perfectly transparent, without colour, taste, or odour, of low specific gravity, and containing only a moderate quantity of saline matter in solution. Its solid contents did not appear to be more than in the proportion of 1.5 grain in 10,000 grains of the water, being somewhat more than the solid contents of No. 1, of the former specimens [of Thames' water], but not more than the average of the whole of them, while it is less than that of the New River. A small quantity of carbonic acid was discharged from it by boiling, but no perceptible quantity of earthy matter was deposited from it by this process. By the application of the appropriate tests, it was found to contain lime, soda, muriatic acid, carbonic acid, a minute quantity of sulphuric acid, and a trace of magnesia. The quantity of lime was about one grain in the 10,000, being nearly the same quantity as in the New River water, while the muriatic acid is considerably less in quantity.

The water marked C is, in most respects, inferior to B. It was transparent, without colour or odour, but it had a very slight musty flavour (perhaps depending upon the cork), and it contained a few floating particles, to which minute air-bubbles were attached; they appeared to consist of vegetable fibres. It did not affect the test-papers until after it had been boiled, when it indicated the presence of a small quantity of an uncombined alkali or alkaline earth; it likewise deposited a minute film of white particles. The amount of its solid contents was somewhat greater than that of B, being nearly two grains in the 10,000, almost precisely the same with that of the Thames at Richmond. It contained more lime and muriatic acid than B, and in addition it exhibited a trace of potash. It contained rather more lime than the New River, but rather less muriatic acid; it must, therefore, be considered not quite so applicable to domestic purposes. But although it appears from the above examination, that B has a decided preference over C, yet it is necessary to observe, that C is equal or even superior in purity to many waters that are employed for the supply of cities, and could not be considered as objectionable for this purpose.

Dr. Bostock's statement is followed by letters addressed to Mr.

Telford by various gentlemen, attesting the good quality of the waters of the rivers Verulam and Wandle, and by a sixth which relates to water from a different source. From three of these it appears that the water of the Verulam is considered good wholesome water, being used by from one-third to one-fourth of the inhabitants of Watford, for brewing, washing, cooking, making tea, and indeed for every domestic purpose, and that it would in all probability be more extensively used, were not the upper part of the town well supplied by other means. From the two succeeding letters we learn that the water of the Wandle is considered suitable for all domestic purposes, being employed for brewing and washing, and in all culinary applications.

The last letter relates to the qualities and applications of water from three several sources used by a family at Harting, in Sussex. These are, a well of some depth, a tank of rain-water, and a small stream which issues from under the South Down chalk-ridge of Sussex, at the distance of a mile, and supplies a mill-pond one-third of a mile distant from the house. "In my opinion," Mr. Telford's correspondent observes, "the most important part of your inquiry relates to tea-making; this foreign plant now furnishing the beverage of all classes, and the use of hard water making a great difference in the strength of the infusion, thus taking money from the pocket of the consumer of the tea, not without also injuring the flavour on his palate." Now at Harting, for the purpose of tea-making, and for personal use, a servant is daily dispatched to the mill, dipping for water below it, which water therefore has always been exposed to the influence of the atmosphere while in the mill-pond, where it deposits a small quantity of chalky matter. The water of the well is used for brewing, and the rain-water (elsewhere so much prized) merely serves for the common purposes of the wash-house, saving the trouble of drawing water from the well. We see, therefore, in this instance, water from a well-known chalky source (not dissimilar, it is remarked, to those of Mr. Telford's north and south streams of intended supply) habitually preferred to rain-water, although the distance of the mill-pond imposes a daily task upon the servants, and while the rain-water pump is at hand in the wash-house.

NOTES ON THE FOREST OF WYRE COAL-FIELD. BY THE REV. THOMAS ENGLAND, F. G. S.—The following is an abstract of a paper bearing this title, which was read before the Geological Society on the 5th of February last.

The district, described in the memoir, is bounded on the east by the Severn, on the north by the coal-field of Coalbrookdale, on the west by the Rea and the Hopton to their junction with the Teme, and on the south by the latter river and the Abberley hills. The superficial transported matter, the author states, is confined chiefly to devastated spots and

hill-tops. The gravel consists of pebbles of quartz, trap, slate, hornstone, granite, porphyry, limestone, and hard grits; and near Chelmarsh church is a boulder of grey granite weighing about two tons.

The next deposit described is the new red sandstone, which the author states consists of only the lower beds of the formation immediately covering the coal. He says that it forms majestic rocks on each side of the Severn, south of Bewdley, and that between Blackston Hermitage and Kidderminster it appears to rise from beneath the forest coal strata. At Winterdine the sandstone is stated to contain beds of conglomerate. From the Borle Brook, near Higley, the formation is said to constitute a long north-west range of high land through Chelmarsh and east of Chetton, bending north-east to Tasley. It consists of beds of white and gray sandstone, sometimes spotted black and brown, of brown clay and loamstone, and red sandstone. The true nature of this ridge, it is stated, may be plainly seen in rising from the Borle Brook to Higley church, and its internal structure partly examined along the Bridgenorth road. To the south of Cardington, both banks of the Severn are said to be capped with the new red sandstone, and the coal series to appear half way down the declivity. The author is of opinion that the coal-measure ranges uninterruptedly from Coalbrookdale to the Abberley Hills. The greater part of the workings are only shallow pits, touching merely the sulphureous beds, locally called "stinkers."

The upper portion of the measures is chiefly composed of sandy, micaceous, thinly bedded loamstone with vegetable remains, sandstone and quartzose conglomerate; the middle and lower part, in which the coal is chiefly wrought, of slate clay, micaceous loamstone, sandstone grit and calcareous conglomerate. Abundance of vegetable remains are found in the shale, but no other fossils.

The author states that this coal-field is peculiar in the constant occurence of a calcareous conglomerate called cornstone. He says it is seen in different parts of the series, sometimes at the top, as at Glazeley, and sometimes in the middle, forming a concretionary limestone. The lowest of the coal strata are described as being more indurated than the upper, and as consisting of brown and gray sandy loamstone, and coarsely laminated flagstone grits, with thin layers of conglomerate of a deep chocolate colour. The author then briefly alludes to the base of the coal-measures or the old red sandstone, and to the intrusive rocks, which he says abound on every side of the great south Shropshire coal-field.—*Proceedings of Geological Society*, Vol. ii. p. 20.

On the probable future extension of the Coal-fields at present worked in England. By the Rev. W. D. Conybeare, M.A., F.R.S., &c. (*continued from* p. 333).

We have already traced the carboniferous beds reposing on the eastern flank of the great anticlinal line of the Pennine chain through Derbyshire as far south as Nottingham; and we concluded with the observation, that it appeared desirable to endeavour to ascertain its prolongation in this direction south of the Derwent.

Mr. Sedgwick has lately ascertained that the transition chain of Charnwood Forest forms an anticlinal line ranging from north-west to south-east*; and he considers the carboniferous limestone of Breedon, &c. as resting against the western slope of this anticlinal in its extension northwards, so that it probably joins on to the great Derbyshire anticlinal in this direction. If so, we must necessarily look for the prolongation of the Nottingham coal-field to the east of a line drawn from Derby through Charnwood Forest, and the insulated hummocks of the same sienitic chain, ranging along the west bank of the Soar nearly to its source. The valley of the Soar below Leicester will sufficiently indicate the most probable line of the extension of the carboniferous deposits, and in the Phil. Mag. and Annals, N. S., for May, 1829 (p. 347), Mr. Forster has already communicated some account of this district, from which it appears that traces indicating coal have been observed at Birstall on the Soar, in this quarter; but still as the whole surface is covered, and as the sub-strata are effectually concealed by the overlying horizontal deposits of red marl; the only prudent mode of proceeding would be to attempt to trace this hidden outcrop of the coal-measures from the known Nottingham coal-field on the north, and to pursue it thence to the south by a regular series of borings. The Charnwood anticlinal line appears, as we have said, to be prolonged southward nearly to the source of the Soar; and in the direction of Lutterworth it must be overlaid by such a mass of new red sandstone and lias that we can entertain little hope of reaching the coal within any workable depth in that quarter.

But on the west of this anticlinal line we find the Warwickshire coal-field, ranging by Atherstone and Nuneaton: this is bounded on the east by a transition chain of grauwacké and quartz rock traversed by beds and dykes of trap rocks.† This coal-field is worked from near Coventry on the south, almost as far as Tamworth to the north.

In Mr. Yates's account referred to in the note, it is said to be bounded on the west by a limestone ranging from Bedworth by

* See *Repertory*, present volume, pp. 115, 264; in the numbers for February and April, 1834.

† In my "Outlines," a hasty glance had induced me to mistake the quartz for a variety of millstone grit, and the grauwacké for coal shale, but I am happy to declare my assent to the correction of my errors by Mr. Yates: Geol. Trans. N. S. vol. ii. p. 261.

Arbury to Annesley; but no description of its character or relative position is given which can enable us to judge whether it is magnesian lime resting on the coal, or an older lime supporting it. As it is said at Bedworth and Arbury to dip west, conformably to the coal, we should naturally conclude it to be the magnesian superstratum; but as at Annesley it is said to have an opposite dip, it may possibly be an older rock abutting against the coal by a fault. This point should be carefully investigated, because on its solution depends the problem, whether the coal of this field is here thrown out, or whether we may expect to be able to pursue it further westward beneath the limestone.*

I conceive it most probable that the Warwickshire coal-field is separated from that of Ashby Wolds on the north, by a prolongation of the same anticlinal undulation which throws up the transition chain of Atherstone and Nuneation already mentioned, although this prolongation is concealed by overlying horizontal strata of red marl.

The Ashby coal-field, which skirts the Charnwood chain on the north-west, appears to be subdivided into the two small basins of Ashby Wolds and Cole Orton by an anticlinal ranging in a direction parallel to that already assigned to the Charnwood anticlinal, viz. north-west and south-east, and passing through the town of Ashby: altogether the sub-strata of this whole district appear affected by so many undulations as to afford scarcely any indications of the probable lines in which we may look for their prolongations, beyond their known boundaries, beneath the horizontal investure of red marl.

Crossing the Trent to the north, and approaching towards the great emergence of the subjacent carboniferous lime of Derbyshire, we find two localities in which coal is worked to the south and south-east of Ashborne, viz. Darley Moor, and Sprinxhall in Edlaston parish. Patches of carboniferous limestone emerge from the red marl in the vicinity of both these pits; but we have as yet no information how far the circumstances indicate any connexion of the coal-measures between them, or with the nearest coal-field on the west, that of Cheadle, which must be within five miles of Darley Moor. According to Farey, however, the undulation of the strata constitutes the Cheadle field into a detached basin; but the whole of this district requires re-examination.

Of the central coal-field, that of Dudley remains for examination;

* I was originally inclined to believe, from the general dip of the Warwickshire coal-field to the west, and that of the south-eastern portion of the Dudley coal-field to the east, that these two fields extended continuously beneath the intervening red marl; but Mr. Yates's observations of the eastern dip of the Annesley lias and a westerly dip along the eastern extremity of the Dudley field, where also, near Walsall, the transition lime emerges, render it more probable that they are separated by an anticlinal line.

but the probable extension of this being connected with the western coal-fields of Shropshire, it will be more properly considered in a future communication, which I hope to prepare for the ensuing month.—*Lond. and Edinb. Phil. Mag. May,* 1834.

A. T.

NOTICE OF EXPIRED PATENTS,

(*Continued from p.* 338.)

John Hague, of Great Pearl Street, Spitalfields, Middlesex, Engineer, for certain improvements in the method of heating hot-houses, manufactories, and other buildings, and of boiling liquids.—Sealed May, 9, 1820.

John Ambrose Tickell, of West Bromwich, Staffordshire, Gentleman, for a cement to be used in aquatic and other buildings, and stucco-work, which is produced by the use and application of a mineral substance, never before employed in the manufacture thereof.—Sealed May 9, 1820.—(*For copy of specification, see Repertory, Vol.* 39, *second series, p.* 332.)

Josiah Parkes, of Warwick, worsted-manufacturer, for a new and improved method of lessening the consumption of fuel in steam-engines, and furnaces in general, and for consuming smoke.—Sealed May 9, 1820.—(*For copy of specification, see Repertory, Vol.* 42, *second series, p.* 198.)

James Jacks, of Camberwell, Surrey, Gentleman, and Arthur Aikin, of the Adelphi, Westminster, Gentleman, for a new or improved method or methods of preventing mildew in sail-cloth and other canvas, and in other manufactures made of vegetable fibre.—Sealed May 11, 1820.

James Scott, of Grafton Street, St. Anne, Dublin, Watch-maker, for a new method of combining, adjusting, and applying by machinery, certain of the well-known mechanic powers, and modification thereof, where power and velocity are required.—Sealed May 11, 1820.—(*For copy of specification, see Repertory, Vol.* 39, *second series, p.* 135.)

LIST OF NEW PATENTS.

Ernst Wolf, of Stamford Hill, in the county of Middlesex, Merchant, for a certain improvement or certain im-

provements in steam engines. Communicated by a foreigner residing abroad.—Sealed April 26, 1834.—(*Six months.*)

John Christophers, of New Broad Street, in the city of London, Merchant, for an improvement or improvements on anchors.—Sealed April 26, 1834.—(*Six months.*)

William Gittins, of Saint Pancras, in the county of Middlesex, Esquire, for an improved mode of applying the water used for the purpose of condensation, in marine and certain other steam engines, to the condenser.—Sealed May 6, 1834.—(*Six months.*)

William Alfred Noble, of Cross Street, Cherry Garden Street, Bermondsey, in the county of Surrey, Engineer, for certain improvements in pumps, engines, machines, or apparatus for drawing, raising, forcing, or propelling water, and other fluids.—Sealed May 6, 1834.—(*Six months.*)

Alexander Beattie Shankland, of Egremont Place, in the parish of Saint Pancras, in the county of Middlesex, Gentleman, for a machine or engine for cutting or fashioning wood into certain defined shapes or forms to fit the same more readily to various purposes and uses. Communicated by a foreigner residing abroad.—Sealed May 6, 1834.—(*Six months.*)

Louis Brumer, of Vineyard Walk, in the Parish of Clerkenwell, in the county of Middlesex, Architect and Civil Engineer, for an hydraulic machine or apparatus (of a centrifugal force) applicable to the raising or forcing water.—Sealed May 8, 1834.—(*Six months.*)

John McDowall, of Johnstone near Paisley, in the county of Renfrew, Scotland, Mechanist and Engineer, for certain improvements on metallic pistons, pump buckets, and boiler for steam engines.—Sealed May 12, 1834.—(*Four months.*)

James Dutton, of Wotton-under-Edge, in the county of Gloucester, Clothier, for a certain improvement or certain improvements in dressing or finishing woollen cloths, and for the method or methods of, and apparatus for, effecting the same.—Sealed May 13, 1834.—(*Six months.*)

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